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A JOURNEY FROM OMDURMAN TO MOMBASA VIÀ LAKE RUDOLF.*

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On October 27, 1900, I was offered the command of a survey expedition in the Sudan, and Major R. G. T. Bright, of the Rifle Brigade, who had twice previously accompanied me in Africa, was detailed to assist me in the undertaking. The next month was employed by us in equipping the expedition, which it was anticipated would be absent from England for about a year.

On our arrival at Cairo it was decided that a medical officer should accompany the expedition, and the services of Dr. J. Garner, who was then attached for military duty to the British troops, were obtained. That was on December 10, and on the 15th he had been completely fitted out, and ready to accompany us on our journey to Omdurman. We left for Assuan by train on the night of December 15, and arrived at Khartum on the night of December 23. During the next few days Colonel Talbot handed over to us the Jehadia—some half-dozen of whom had accompanied Major Bright and me the previous year when we visited Abyssinia—our transport animals, saddles, rifles, ammunition, tents, etc., etc., and, taking three months' supply of food with us, we started on our journey up the Nile to Nasser on December 29. The gunboat *Fateh*, which was our home for the next fortnight, towed two double-decked barges and two sailing-boats, in which all our animals, men, rations, equipment, etc., were accommodated. All told, we numbered sixty-two men, including ourselves, servants, escort, and transport drivers. We proceeded without incident up the Nile, reaching Fashoda

* Read at the Royal Geographical Society, April 14, 1902. Map, p. 788.

on the night of January 6, Taufikia the next day, and thence continued up the Sobat river.

Nasser fort was reached by the expedition on the evening of January 11, and there we met Blewitt Bey, the Mudir of Fashoda, who accompanied us some 9 miles up the Sobat river the following day, to a point where it had been decided the expedition should disembark and continue the remainder of its journey by land. During the next two days all the transport animals, equipment, etc., of the expedition were landed, and the Mudir returned to Taufikia in his steamer on the morning of January 14, 1901, followed shortly after by the *Fateh* and the sandal and gyassas, which had brought us so far from Omdurman by water. We were cut off now from all communication with the outer world, of which we heard no news again until we reached the Lake Baringo post on August 2.

A start was made on the 17th, and a most unsatisfactory one it was. Following the river for a mile, we struck across country to avoid a big bend, and at once became involved in long grass, which concealed great deep cracks in the ground caused by the drying up of the swamps. Into these cracks the poor little donkeys kept constantly putting their feet, and fell down in a most helpless state. It was often necessary to dig away round their feet in order to extricate them from the cracks in which they were firmly wedged. As a result, it was past 2 p.m. before we struck the river again and were able to camp, although we had only marched some 4 or 5 miles. The camp remained halted the next day, whilst a party was despatched to bring on the food left behind. In this way, proceeding easily by double stages, we travelled along the Sobat to its junction with the Pibor, and then struck south along the latter river, very much along the route followed by Major Bright and me the previous year, to the junction of the Gelo and Pibor rivers near the village of Bil. Here the Nuer guide obtained for us by Blewitt Bey desired to return to Nasser as he feared to proceed further. Sheikh Yowe and all his people, who during the rainy season inhabit the Koratong group of villages some 8 or 9 miles south-west of Bil, had moved to the latter place for the dry season. A deputation was therefore sent to Sheikh Yowe, asking that we might be provided with a guide to conduct us to the junction of the Akobo and Pibor rivers. In accordance with our request, he sent us one of his own sons; but this man gave us the slip soon after we started next day, and we never saw him again. Having previously traversed this portion of the journey, it did not very much matter, so we continued without a guide, and had little difficulty in reaching the Pibor-Akobo junction on February 4, 1901.

We had by this time consumed our surplus food, and were able to proceed direct; and were fortunate in finding some Anuak natives settled temporarily at the river junction, two of whom consented to

guide us for a few days along the Akobo in return for presents of beads. On February 5, therefore, we started in an easterly direction along the Akobo, and two days later reached our old camping-ground of May 15, 1900, where Major Bright and I had first struck the Akobo when leaving the Gelo river. Travelling was somewhat laboured owing to the long grass not being burnt by the natives, which is always done when it has become sufficiently dry to ignite readily. Hitherto, however, we had experienced little trouble from swamps; but we were soon to encounter these formidable obstacles, which caused great delay in working round them on higher ground away from the river. Indeed, more than once we were compelled to retrace our footsteps for several miles, as we were unable to proceed in the direction we desired to. Between February 9 and 16 we were unable to camp on the river at all, owing to broad belts of swamp, which effectually prevented us approaching the stream. Every night, therefore, we were obliged to camp on the edge of this swamp, where at sundown the mosquitoes appeared in myriads, and made one long for day. We had now reached the Anuak district of Tedo, and the guides wished us to cross the river at this point, as the travelling was reported better on the north or right bank of the river. We were separated from the main stream by a thick belt of tall coarse grass a mile wide and several swampy overflow channels, so Major Bright and Dr. Garner were employed on the 16th in improving the approach to the river and the track on the far side. Thanks to this work being thoroughly well done, we had little difficulty in crossing on the 17th, and continued in an easterly direction away from the river to high ground, where large numbers of Anuak huts were dotted about midst cultivation. All the natives, however, fled at our approach, and it was almost impossible to get them to come near us, in spite of our being accompanied by several of their fellow-tribesmen from the opposite side of the river. To do our guides justice, they were the most accomplished looters I have had the pleasure of travelling with, and never hesitated for a moment, when they had the opportunity, of clearing out their own brothers' huts of all they possessed, unless prevented from doing so. Possession is most obviously nine-tenths of the law amongst these simple (?) savages.

Our next march south from Tedo was at some distance from the river, both banks of which were fringed with a broad belt of long grass and swamp as far as the village of Neum. Here we struck the river again, and camped in a most charming spot under giant sycamores, of which there was almost a forest growth along the banks. Numerous Colobus monkeys found food and refreshment here, whilst many lovely birds and butterflies added colour to the scene, which was further enhanced by the pretty cotton-plant flowers—a pleasant change from the dreary swamp land, often devoid of even a single tree, to which we had become accustomed. From this point on the country is

generally well wooded, although in many places bordering the river bank large areas of swamp exist. On February 22 we obtained our first view of a hill since we had left Nasser. This is a fine rugged isolated mountain, which attains a height of 3550 feet, and is known to the Anuaks as Ungwala. A long march of 16 miles on February 24 brought us to the foot of this hill, and we camped for the first time on gravelly soil, between it and the river.

I may here note that in Bòttego's map this mountain, called by him Ischeno, is shown on the wrong bank of the river. The next day we discovered two small lakes during the march, most picturesque pieces of water, which I named after my two comrades, Lakes Garner and Bright. The country now became more undulating, and although in many places the river-banks were clothed with long coarse grass, we were always able to proceed without much difficulty along the higher ground overlooking the river. On several occasions we saw herds of magnificent elephants, and on two separate days were compelled to halt the whole caravan in order to allow these majestic brutes to cross our path in front of us; this they did in a most leisurely way, causing something of a panic amongst our mules and camels, who little appreciated the proximity of these lordly beasts. During our last days on the Akobo river, much delay was caused by our having to cross from one bank to the other, as our guides would only take us by routes familiar to them. Fortunately, the water was seldom over knee-deep in these upper reaches of the river; but the banks were generally steep, and had to be especially prepared for the passage of our large number of transport animals.

On February 27 we camped for the last time on the river Akobo, which here flowed from an easterly direction before turning north. I estimated we were at the point where Bòttego in his map shows the large village of Melile. Of this place, however, we could find no trace, nor was the name even known to the guides who accompanied us. For some days past we had obtained glimpses in the early mornings of the lofty Abyssinian mountains away to the east of our route, the more important peaks of which I was able to fix approximately. The highest point was over 8000 feet above sea-level, whilst others ranged between 7000 and 8000 feet. I decided at this point to leave the Akobo river (which had previously been explored for some distance further up-stream by Bòttego, whose maps were very reliable), and to strike south along a small stream known to the Anuaks as the Ajibur, which, though at this time of the year was not running, still contained small pools at intervals. A small lake was formed a mile or two above the junction of the Akobo and Ajibur rivers.

On February 28 we crossed the Akobo, and, travelling for about 3 miles in a south-westerly direction across undulating country, struck the bed of the Ajibur, which we crossed and followed approximately

for the next few days, always happily finding pools. To the west of our line of march isolated peaks sprang up at intervals, all of which were over 3000 feet in height. These and the ridge connecting them form, in my opinion, the water-parting between the Ajibur river and a stream reported by the Anuaks to exist some 15 to 20 miles to the west, which is known to them as the Neubari. Our guides had only heard of this stream, however, and had never visited it, I believe. Does such a river exist, I think it may possibly be identical with the late Captain Wellby's Ruzi II., as we had previously come across a swampy stream approaching very closely to the Akobo on February 21, which here was known to the Anuaks as the Oboth, and which they averred merely took off from the Akobo, some 10 miles distant. I have assumed in my map that the Neubari possibly enters the Oboth, and that the combined streams subsequently flow west to the Pibor, and not again into the Akobo.

On March 3 we camped for the last time in the plains before entering the hilly tract of country known as Boma. For the next few days our progress through these hills was extremely slow, as the track was in places very steep, and we were subjected to heavy rains, which not only converted the numerous little streams we had to cross into rapid mountain torrents, but also rendered the track very slippery, and in places boggy. Several streams, in fact, had to be bridged before we could cross our transport animals.

The scenery of this little mountain district was at times grand, as magnificent rocky crags and pinnacles were visible on nearly every side. The soil is an extremely fertile red loamy clay, and, I should say, capable of producing all kinds of cereals. The climate is delightful, the air being fresh and pure (as compared with the low-lying swamp land we had previously traversed); for all this country ranges from 3000 to 4000 feet above sea-level, whilst higher ridges and crags attain to almost an altitude of 6000 feet. The natives, though not unfriendly, are shy, as they are not only harassed by their more powerful neighbours to the south, such as the Magois and Karuno tribes, but the Abyssinians also pay them periodical visits. In consequence, on the approach of our caravan, they immediately concealed themselves, and it was with considerable difficulty that we eventually persuaded them that our intentions were friendly, and were able to procure a guide. On March 7 we crossed the highest ridge that the track led over, and then abruptly descended on the far side (from 3700 feet to 2600 feet) to the sloping glacis at the foot of the hills, which falls another 400 or 500 feet into the seeming dead level vast plain, extending as far as the eye could see, from the summit of the pass, away to the west—in fact, probably as far as the Nile and beyond. We now worked in a south-westerly direction to get out on to the plain, as the ground near the base of the mountain range (which ran north and south) was much

broken up, and difficult for transport animals. We almost at once passed out of the rain zone, and were very shortly confronted with a barren desert.

In spite of large herds of zebra, hartebeeste, ostriches, and gazelle roaming these plains, which seemed to point to the fact that water must be plentiful somewhere, we experienced a most anxious time regarding this precious fluid. On March 11 we passed a large pool 6 or 7 miles after starting, but as it was too early in the day to camp, we proceeded, as we hoped to find water on ahead. By 2 p.m. we had marched $17\frac{1}{2}$ miles, and were still in this burnt-up plain, and had found no traces of water. To continue with all our animals and the men showing signs of exhaustion seemed rash, as we had no one to tell us where water was likely to be found. The heat, too, had now become very great; so I decided to camp, unload all the animals to rest them, and to send off a search-party under Mabruk Effendi, accompanied by five camels and fifteen donkeys carrying saddles and water-skins. I instructed Mabruk Effendi to work in a westerly direction towards a prominent isolated craggy hill some 20 miles to the west of us, as I hoped by so doing, after marching some 7 or 8 miles, he might strike Wellby's Ruzi river No. II. The improvident men had early in the march emptied their water-bottles, but I did not feel disposed to return 10 or 11 miles along our track to the pool passed early in the day, as we should still have the difficulty regarding water ahead to face. It was a wretched afternoon, as there was not a drop of water in camp beyond what Major Bright, Dr. Garner, and I had in our water-bottles, and before long the great heat had such an effect on the men that the eyes of several of them literally appeared to bulge from their sockets.

Shortly before retiring to rest, a horrible idea seized me that we must be in the middle of the desert—where Mr. Donaldson Smith's expedition for three days had experienced such dreadful torture for want of water—in which case the Ruzi II. was here non-existent. I firmly believed then I had sent off the unfortunate search-party to their utter destruction, and could get no sleep in consequence, as none of them had returned. I sat up all night outside my tent in my chair, and as soon as the moon rose, shortly after midnight, I decided to send back another party of six men riding six donkeys, and taking all the men's water-bottles in camp, with orders to return to the pool some 10 miles distant, fill up, and come back as quickly as possible. This done, I felt at all events we could face the return journey to the pool on the morrow in the event of Mabruk Effendi and his men failing to find water, and be able, in addition, to spare a little for his exhausted party.

Morning dawned with not a cloud in sight. Anxious eyes scanned the western horizon, but not a trace of Mabruk Effendi's cavalcade could be seen. About seven, however, distant figures were observed, and through our glasses we made out camels, and later, donkeys and

men. Their progress was very slow, and it was some time before we could see sufficiently clearly that the animals were carrying heavy loads. Then our hopes were raised indeed, for we knew that water must have been found. In due course, the men and animals, all dog-tired, reached the camp. Mabruk Effendi had saved the situation by his indomitable pluck and determination, for, after a long weary search, he had come across a large swamp out on the plain, from which he had brought us gallons and gallons of water, as all the skins had been filled. We had more water than the men could drink now, for shortly after nine the other party sent back with water-bottles also arrived. We were able, in consequence, to give all the animals a taste of water each, and about 12.30 p.m. made a start for Mabruk Effendi's swamp, which fortunately proved to be only 7 or 8 miles distant. Even so, eight or ten men had so much felt the effect of being without water, that they were with difficulty got into camp before dark. It was a lesson, and a severe one; but it taught the men to be far more provident in the future regarding reckless drinking of water on the march. For what a fluke it had been that water was discovered in the direction I had indicated! Beyond that small area of swamp, it is not unlikely that no other water existed on that fearful desert plain.

We remained halted for March 13 and 14, to give men and animals ample time to recuperate, as we learnt from a small colony of natives settled on the swamp that there was a long march south before we would reach water again. Two of them consented to act as guides in return for presents of beads, so we made a fresh start on the 15th, and, after a hot tiring march of 20 miles over this dreadful plain, struck a large pool in the Karuno river shortly before dark. Our guides would proceed no further, so for the remainder of our journey to Lake Baringo, except for a few days, when we were accompanied by Suk youths when approaching that place, we were left to our own devices. I decided at first, at all events, to follow this river in an easterly direction towards the hills, where there seemed more prospect of obtaining water than out on these inhospitable plains. We crossed the river on the 16th, and on the 17th proceeded approximately along its bank, and later camped amidst a thick growth of thorn bush, in an old camp of either Dr. Donaldson Smith's or Captain Wellby's, where we obtained water by digging in the sandy bed of the nullah. We met large numbers of Karuno natives during this march, brilliantly decked out with fine ostrich feathers dyed different colours. I imagine they must be closely allied to the Magois people (first described by Dr. Donaldson Smith), who, we understood, had recently been driven further west by the powerful Turkana tribe; these had come north in force, and raided large numbers of cattle and goats and sheep, which they had succeeded in carrying off with them. The Karuno are not unfriendly, but extremely suspicious, so we had little opportunity of ascertaining much

information from them, as they stoutly refused to provide us with guides.

The country lying to the east of us consisted of a thorny plain which extended to the foot of a precipitous-looking range of hills, a veritable rocky escarpment running north and south. It seemed hopeless to attempt to climb this, so I decided to try and work round it in a southerly direction before proceeding east to our goal—Murle, on the river Omo. We struck south, therefore, on March 18, towards an isolated peak in the plain, and then turned south-east to a prominent outlying hill of the main range, where happily we found some small pools of water up on the hillside. Continuing round the foot of a rocky escarpment, generally in a south-easterly direction, next day we reached a dry khor, which seemed to promise water on digging. We were unable to find any. We had, however, sufficient water in skins to last the men for one day, so in the afternoon parties were sent out to search. One man eventually returned after dark, reporting the existence of a large pool some miles distant at the base of a large valley thickly wooded with thorn bush, and enclosed to the south by irregular ranges of hills. We were rather shut in by hills, through which I was anxious to find if a pass existed; so next day the camp remained halted, whilst Major Bright went with a party to fill our skins with water and bring it on animals to camp, and Dr. Garner I despatched to look for a pass where I thought there might possibly be one.

His report proved satisfactory; so next day, carrying water as usual, we had little difficulty in climbing the pass, and then continued as before along the foot of the rocky escarpment, until we reached a point where it abruptly ran back in a northerly direction for some 10 to 15 miles. Thence the range ran east and west and subsequently south again, forming a long narrow bay, as it were, enclosing an open plain swarming with game. We camped without water, but later ascertained the existence of a small stream with pools in the centre of this enclosed plain, to which we marched next day. On March 22 we continued in an easterly direction over an easy pass at the foot of a rocky crag, and camped some 5 or 6 miles further on in another plain, where we obtained water by digging in the sandy bed of a dry khor. From this point we obtained our first view of Mount Naita, a grand mountain mass terminating in a lofty conical peak, which attains a height of over 7000 feet. I had previously approximately fixed the position of this peak in my journey along Lake Rudolf in 1898, as it is visible from a great distance, and for the next five or six weeks we seldom lost sight of it.

For the next two days we travelled generally in a south-easterly direction, and were fortunate in striking pools of water. Being without guides in an absolutely unknown country, we had literally to feel our way over this plain, thickly wooded with thorn bush. The anxiety

regarding water had told in some cases on the men, who appeared a bit unnerved, and performed their work in an apathetic manner, as though they anticipated disaster. For the next week we proceeded generally in a direction slightly to the north of east, through a somewhat hilly country, where the difficulties regarding water still continued, and placed us on several occasions in a most unenviable position. Fortune favoured us, however, and when affairs looked their blackest, something always turned up to relieve us of anxiety. Nevertheless, it was with no small satisfaction that, when we reached the Sacchi river on April 1, we found it a fine running stream—the first flowing water we had seen since the beginning of March, when we were in Boma country. By the irony of fate, later on the same day, when following this river we became involved in a most formidable swamp, around which we worked with considerable difficulty, and were unable to camp on the river at all. We eventually found a fairly dry spot amidst thorn bushes, and camped here near a pool.

The escarpment we had lately been skirting, I am inclined to think, must be the edge of a high-lying plateau, varying in height, probably, from 3000 to 5000 feet above sea-level. I imagine all that country to be healthy, possibly well watered and fertile, and very closely resembling Boma in general features. I am sure a most interesting field for exploration exists on those hilly regions, which we were compelled to avoid, encumbered as we were with transport animals.

For the next three or four days we followed approximately the course of the Sacchi, which was clearly marked by a broad belt of tall trees; near the river a fine forest growth existed (the haunt of numerous elephants), which made it extremely difficult to find or reach the river-bank. On April 4 we camped on an open plain, the river-bank being here free from trees or vegetation, some 7 or 8 miles to the north of Mount Nakua, a familiar landmark of our previous visit to Lake Rudolf. I now knew that probably a 20-mile march in a direction slightly south of east would bring us to the Murle district on the Omo river, and this march was successfully accomplished on April 6. On the eighth, we continued some 5 miles in an easterly direction to our well-defined camp of September 15, 1898, on which I closed my survey from the north. The result proved most satisfactory, as the new position obtained for this camp, working from Nasser as my base, agreed within half a mile of the previous position obtained by me in 1898, when working north from the Mombasa side.

Our food supply was running extremely short, in spite of our having for some time past greatly reduced the men's rations, so it was decided to proceed leisurely up the Omo, with the twofold object of buying from the natives and meeting the supplies which we hoped might be being conveyed south towards us, and were merely delayed by the heavy rains which about this time commenced. On the 9th we marched

north, into the Kerre district, halted there the 10th, but could not induce the natives to trade, so moved on again a little further north on the 11th and 12th. At the latter camp we halted for two days, but could obtain no food at all from the natives. The river-bank was extensively cultivated; but the grain was in a green condition, and would not be ripe for at least another two months. The higher we got up the river, the more backward became the crops. We now began to get extremely anxious, as we had very little food left; the natives either had none or were unwilling to barter what they had, and of the expected supplies we could learn nothing.

There was still one more chance of obtaining food, perhaps, in the Mursu district, further north again, as Dr. Donaldson Smith the previous year had purchased and reported plenty in that neighbourhood. We decided, therefore, to proceed there, and a miserable time we spent during the undertaking. We were subjected to terrific storms of rain, which converted the plain into bog, and formed shallow lakes of water all over the country, rendering our progress far from pleasant. When we reached the Omo by cross-country marches, cutting off a great bend of the river which flows in a north-easterly direction, we found ourselves confronted by most extraordinary broken ground—a bewildering labyrinth of low clay cliffs and depressions. Through this sort of country we proceeded for two days in a westerly direction, but were unable to camp on the river, which was fringed by an impenetrable forest growth, the ground being inundated with water. We struck two small lakes, on the margin of the larger of which we camped on April 19—a most picturesque sheet of water, first previously seen, I believe, by Dr. Donaldson Smith.

It was most confusing work hunting up a possible route through this broken country, and we were compelled to zigzag about in a most annoying manner in our endeavours to proceed west. The country seemed to be absolutely deserted except for a few stray natives, none of whom lived on the bank we were following; and as for food, we saw practically no signs of it, and consequently obtained none. In little over a year the country had changed from a fertile, well-populated district to a barren one. The rains continued with unabated fury, and seldom had any of us experienced such terrific storms at night as those to which we were now subjected. Our animals were beginning to show serious signs of breaking down, as the Sudan camels and donkeys are quite unaccustomed to this sort of weather.

It was obviously suicidal to proceed further north, as even here in the plains we were doing badly, and had we continued into hilly country and forest, with its attendant cold as well as rain, I felt in a short time we should lose every animal we had. I decided, therefore, to return again to Murle, to see if during our absence the food supplies had arrived. Could I get no news of them by April 25, I had made up

my mind that our only hope of salvation, seeing the extremely critical position we were placed in regarding food, was to immediately make south along the western shores of Lake Rudolf for the Ribo post, living as best we could on our transport animals. Before leaving Omdurman we had read Sir Harry Johnston's report from Uganda, in which it was stated that a post had been, or was shortly to be, established at that place. I frankly admit that I anticipated a loss of perhaps 25 per cent. of our men and about 50 per cent. of the animals in the undertaking; but in my most pessimistic mood I never imagined the dreadful loss of 75 per cent. of our personnel, which we actually suffered, nor the terrible experiences we were to undergo before reaching safety. By one long and one short cross-country march from Mursu we reached our old camp on the Omo, near where we first struck that river on April 6.

There was no news of the food supplies, so we rested on April 23 and 24. During this interval of rest, one of the transport drivers, who had been with Major Bright and me on a previous expedition, mysteriously disappeared. I have little doubt that, whilst out in charge of the donkeys when grazing, he had gone off on a marauding expedition by himself, and had been speared by the natives. Search-parties were sent out, but no trace of him was ever found, as his body had evidently been thrown into the river. Up to this time our losses in transport animals had been very slight, considering the little rest they had had. We still had 11 camels, 10 mules, and 114 donkeys; but about this time some of the camels began to sicken, and in a short time several died, probably from eating some poisonous herb.

All arrangements being completed for the journey south, we made an afternoon march on April 25, as I considered it unlikely we could accomplish a 20-mile march now to the Sacchi, owing to the soft boggy nature of the ground after the recent heavy rains. Next day we travelled well for the first 4 miles, and then became involved in a frightful bog, through which the animals were only taken with great difficulty, and on the far side of which we were compelled to camp. It occupied us the whole of the next day reaching the Sacchi, which was only done just before dark. We had taken three days to accomplish what three weeks before had only taken us one. We now found that the Sacchi had recently overtopped its banks, and the country had been converted into swamp. We travelled 3 or 4 miles along it next day in a southerly direction, and crossed to the west bank, where the going seemed to be better. We found it impossible, however, to work towards the north-west corner of Lake Rudolf, owing to the swampy nature of the country, through which our animals were quite unable to travel. For the next five or six days, therefore, we were working round this swamp at the foot of the Lorusia range of mountains, some miles away to the west of the lake. I would here remark that several powerful streams during the rainy season flow from the west into the

Sacchi river, which spills into a large area of swamp at the head of Sanderson gulf, before the shores of Lake Rudolf are actually reached. At one time it appeared extremely doubtful if we could continue south; but we were fortunately able eventually to follow a dry route, and on May 5 were camped on the bank of a khor, which I felt sure must be the one entering the lake near Lumian.

Here our first great calamity befel us, as three of our men were murdered not a mile from camp. The fact remained unknown to us until nearly 3 p.m., when news was brought into camp that a non-commissioned officer, an askari, and our cook were lying dead on the plain, having been speared by natives. The details of this treacherous attack will never be known, as the natives were not seen. On receipt of this shocking intelligence, I despatched Dr. Garner with camels and an escort of twelve men to bring in the bodies, which were buried outside camp just before dark. That night for the first time we saw a comet in the constellation of Orion, and several discussions took place amongst the superstitious ones as to whether its advent was a good or evil omen. I fancy the impression that it was an evil one for us was probably more generally favoured. At all events, that same night about 1.30 a.m., with the assistance of a full moon, a band of from forty to fifty warriors made a dash for the camp, yelling like demons as they charged. Fortunately, every man was sleeping on his post round the camp as usual, and as their nerves had been highly strung from the afternoon incident, the sentries were all on the alert and especially watchful.

As we were unable to construct a thorn zariba round the camp, the promptitude of the sentry in front of our three tents, which was the side attacked, probably saved our lives. Shouting for the guard to turn out, this man fired as he shouted, and in less time than it takes me to describe it the whole of this side of the camp were firing at the advancing foe. The latter were unable to face our rifles, and turned and fled without penetrating our line of men. It was one of the quickest and smartest pieces of work we had ever seen done, and I was very highly gratified to find the excellent fire-discipline observed by the men. There was no wild senseless waste of ammunition, and firing ceased directly the enemy disappeared, which I need hardly say is not always the case with native troops who have been suddenly alarmed at night. A second attack was also attempted by another body on the rear face of the camp, but they were easily driven back, leaving several spears which they had hurled into the camp, but which had done no damage. It now became most obvious that the natives of this district, who formerly in 1898 were quite friendly, were now bitterly hostile.

As we had never harmed them in any way, and were always most anxious to establish friendly intercourse with the natives we met, I can only think that this sudden change of feeling towards Europeans had been brought about by ill treatment subsequent to our former visit.

The following morning we marched 2 to 3 miles in an easterly direction along the khor, and reached our old camp of September 8, 1898, at Lumian. The natives dogged our footsteps and followed on our flanks to Komogul, where we camped that day on the bank of a khor, from the bed of which we obtained water near the surface. As there were large numbers of natives lurking about among the trees and bush, we made our position defensible for the night, but were left unmolested. The next day we made only a short march, and camped for the first time on a low cliff overlooking the lake. As the country was fairly open, the natives did not venture to approach too closely, although they took up prominent positions for observation purposes, screened by bush. Continuing next day, we camped near the foot of an extinct volcano, Lubur by name, and here I was taken seriously ill with gastritis, which rendered me so weak that Dr. Garner advised a halt on May 9 and 10. We started again on the 11th, and travelled in a southerly direction along the lake-shore; but I was compelled to ride a camel at the head of the column for some ten days, as I was too weak to march. The poor grazing was telling severely on our camels, who became extremely emaciated and weak, so we began to kill the sickly ones for food purposes. Their condition was so wretched that our progress on the march was dismally slow. The small ration of grain to which the men were, of necessity, restricted also began to make itself felt, and for the first time demoralization set in amongst the transport drivers. These latter gorged themselves in such a bestial manner with every portion of a camel, including the hide, feet, blood, etc., that before long several of them showed signs of breaking up. On May 19 three Jehadia (transport drivers) died, whilst a fourth, in spite of repeated orders, went outside the camp zariba shortly before midnight, and came yelling back into camp with a spear-wound through him. He was carried on a donkey for several days before succumbing.

Time after time the men had been warned that our every movement was being watched by hostile natives, who, although unseen, were always lying in wait ready to spear any stragglers who might wander from the precincts of camp unarmed. Our men, more especially the Jehadia, were visibly suffering greatly for the want of carbohydrate food, as the supply of grain issued daily as a ration was extremely limited in quantity, and on meat alone they seemed quite incapable of maintaining their strength. Our line of march was daily hampered, in consequence, by our having to mount ten or eleven men on donkeys in rear to get them along at all. The fine discipline of the regular soldiers enabled them to carry out arrangements whereby they all messed together; but the other men so little trusted each other in their present straits that they fed independently, and therefore derived considerable less benefit from their rations. Ultimately, when our losses had become so serious that there appeared grave doubts of our

ever getting through, a general mess for the whole camp was insisted on, and proved much more satisfactory. On May 22 we camped for the last time on Lake Rudolf, and next day marched across country in a southerly direction to the river Turkwell, the sandy bed of which was half a mile wide where we struck it.

I have somewhat abruptly dismissed our journey along the shores of Lake Rudolf, as I have previously written a description of that great reservoir. We found the water of the lake at a lower level than in 1898, due to the exceptional drought of the previous year, when the Omo river was quite dry. The water was far more nauseating than formerly, and the numerous lagoons we remembered as teeming with wildfowl of many varieties were to a large extent dry, and birds were conspicuous by their absence, so even this source of food was denied us; whilst big game is practically non-existent on the western shores of Rudolf, which constitute grazing-grounds for Turkana flocks and herds.

The Turkana were settled in large numbers along the Turkwell, but behaved in a most treacherous manner; although pretending friendship and conducting us some 5 miles down the bed to a water-hole, they seized the first opportunity and speared one of the donkey-corporals out on grazing guard. The man died next day. It was obviously useless trying to maintain any friendly relations with these people, which I was most anxious to do, seeing the weak state of the caravan.

In 1898 the Turkana of the Turkwell had harassed my column of 180 men, and caused much trouble and anxiety, owing to their repeated attempts on our transport animals whilst grazing. It may be imagined, therefore, that with one quarter of those numbers, and the larger majority of the men incapable of much active work, I did not at all relish the passage through their country under present conditions. There was no alternative, however, and our one chance of salvation was to exercise extreme caution, and to give as little opportunity as possible for the Turkana to do us serious damage.

We continued west along the Turkwell, marching in the bed of the river, as the banks were thickly wooded and afforded too much cover for an active foe to be pleasant for us. Daily the condition of our men became worse, and I am not using too strong an expression to describe our progress on the march as perfectly appalling. We had previously cast away many loads, to lighten the work of our men, into the lake, and on May 24 a further large consignment of tents, trophies, spare saddles, and many other things no longer indispensable, were committed to the flames. On May 27 we had a dreadful march, and four men died after we had got them into camp. It would become monotonous were I to proceed to describe our daily worries and anxieties regarding the men and transport animals, so I will pass as rapidly as

possible over our horrible experiences, on which one little cares to linger. The ever-present Turkana following us incessantly greatly added to our difficulties.

On reference to my diary, I find that so early as June 2 sixteen of the Jehadia had either died or been killed; one servant had died, and another been killed; whilst two askaris had been killed, and one had died. Our original force of fifty-nine blacks all told had been reduced to thirty-eight already.

Travelling along the Turkwell was always an unpleasant and anxious business, as the thick forest growth and dense vegetation bordering the banks made progress along the river almost impossible. We were compelled, therefore, every day, either to proceed up the bed, now containing a running stream about knee-deep, which was a very laborious undertaking; or, on leaving camp, to strike away from the river through a thick belt of thorn and dwarf palm to the higher ground, which was more open, but thickly covered with wait-a-bit thorn. Proceeding along the higher ground in a southerly direction, about 11 a.m. we used to turn off in a south-westerly one, with a view to reaching the river-bank again to camp. This was always the most anxious part of the day's march, as one never knew what dense growth we might have to encounter, or when we were likely to reach the bank of the stream, which takes a most erratic northerly course to about 3° 6′ N. before swinging east towards Lake Rudolf. With a professional guide, in 1898 we had on several occasions spent two or three hours finding the river again towards the end of a day's march, being frequently badly hung up by the thick nature of the country, which prevented our forcing a way through.

On the whole, during our present journey south along the river, we met with extraordinary good fortune in our endeavours to get down to the water, and were not often badly involved. Our progress, however, was funereal in the extreme, owing to the debilitated state of the men (some ten or a dozen of whom were being daily carried on donkeys), which left very few partially sound men to drive the animals and look after them in this much-enclosed country. Day after day we crawled along, and on June 11 reached the outskirts of the Ngaboto district—the most southerly one of the Turkana—which was densely populated by natives. Dura was growing in quantities along the river-bank, but was all green and unfit for food, so we could obtain no grain, much to our disappointment, as we had hoped against hope to be able to purchase a little here. On June 13 we crossed the river Weiwei, which flows from the south into the Turkwell, and began to breathe again, as we trusted that we had seen the last of the Turkana, their country terminating hereabouts. They treated us to a parting shot though, by spearing the best of our remaining Jehadia that day just before dark. He foolishly crossed the river unarmed to look for

a missing donkey, when presently we heard the most blood-curdling yells, and, rushing to the river-crossing, found him lying dead mid-stream with four spear-thrusts through him. The Turkana had disappeared, of course, like magic through the thick vegetation.

We halted to rest the expedition next day. Our numbers were now reduced to thirty-two, out of the total of sixty-two (including our three selves), whilst our transport animals consisted of five mules and seventy-six donkeys. As soon as the camels had all died and been eaten, we had at once commenced eating donkey-flesh towards the end of May. Until we reached the Baringo post at the beginning of August, this was the sole meat supply we all enjoyed.

We now struck away from the Weiwei river in a south-westerly direction towards the foot of the Suk hills, which are a northerly continuation of the Elgeyo range. Our first march from the Weiwei was the most disastrous one of the whole journey, no less than six men collapsing in spite of the previous day's halt. Several of these, we were aware the previous evening, would not last out the march, in spite of being held on to donkeys; but we never contemplated quite such a collapse. We camped on the bank of a fine running stream that day, and I may here incidentally mention that I shot two vultures that were rather annoying. To my utter astonishment, there was a rush for these loathsome carrion, which were quickly plucked and boiled and subsequently devoured! We still continued in a southerly direction along the foot of these mountains, and experienced difficulties again regarding water until we reached the most northern Suk settlement of Sekere on June 17.

Here for the first time I noticed an extraordinary, to me, number of purple spots all over my legs, which I showed to Dr. Garner. A few days later, hæmorrhage of my mucous membranes set in, and I became in course of time so seriously ill with scurvy that I almost succumbed to this disease.

On June 20 we reached Marich, so familiar to Major Bright and myself, as we had previously visited this place in 1897, and again in 1898. Throughout the dreadful journey south we had always tried to buoy up the hopes of the men and ourselves by saying that once we reached Marich we would be safe, as food would be obtainable in abundance. There was none obtainable. The former smiling fields of grain we remembered so well had all disappeared, and their place was taken by long coarse grass and rank vegetation. The natives were no longer the prosperous ones they were. They were quite friendly, however, and we obtained the services of a Suk youth, who had a smattering of Ki-Swahili, and informed us that he knew the site of the Ribo post, to which he would conduct us in return for a present of two goats; to this we readily assented. I should like to meet that guileless youth again, as, after conducting us for several days to a point a few miles

south of the Kivas district, and landing us in a most atrocious bit of country, he quietly gave us the slip whilst tending our goats and sheep midst long grass after we had camped. His absence was not discovered until evening, when all the animals were brought in as usual to camp; then it was found that not only was he missing, but seven goats also, including all our milch ones! Needless to say, we never saw him again; but I live in hopes that we may meet again some day, when I may have a few points to discuss with that cherub boy.

On the Suk youth departing, we found ourselves involved in a most difficult tract of country along the lower slopes of the mountains, much broken by small ravines and mountain torrents, the banks of which were clothed in tall rank vegetation. We proceeded with much labour, as I could find no tracks through this dense growth until eventually we reached a well-populated district, known, I believe, as Chemtubell or Ndao. This place was reached in a state bordering on collapse. Our numbers had been reduced to seventeen blacks, most of whom were utterly exhausted, as were also the transport animals after our last few days' experiences, whilst my condition also was causing a certain amount of anxiety. All we now had left for the men was some 15 to 20 lbs. of grain we had a few days previously purchased from the Suk at Kivas.

In spite of our unpleasant position, we were obliged to have a rest, and, as we were camped midst cultivation, we proceeded to try and get the natives to bring in grain for sale. Our efforts met with little success for the first two days; but our luck changed with the advent of the month of July. We still had some five sheep left, which we had reserved for such a contingency, and as the natives would not look at beads, we slaughtered our sheep and exchanged meat for heads of nearly ripe grain.

Who these natives were we could never ascertain. Their hamlets, like those of the Suk, were built high up on the hillsides, and their fields were irrigated in a similar manner to those of their northerly neighbours. They are possibly an offshoot of the Wa Elgeyo, and utilized bows and arrows in preference to spears.

It was not until July 10 that we made a fresh move forward, and on that day we marched some 5 to 6 miles in an easterly direction to the river Kerio, which was crossed with considerable difficulty. Thence we continued in a south-easterly direction across the Suk plains with the object of hitting off a pass in the hills, where the plains terminate to the south. It was most necessary to find this point, as the success of our journey south towards Lake Baringo depended almost entirely on our finding it, and water in the valley of the Karuan beyond. We were delayed some days in crossing this plain, owing to relapse from nasal hæmorrhages from which I suffered, and only proceeded slowly in consequence. In spite of this, two more askaris and my servant—

Hanna, the last of our personal attendants—collapsed, and when, on July 20, we reached one of our old 1897 camps at Kisite, only fourteen blacks now remained with the column. Here for a week I was at death's door, suffering from the most severe relapse I had yet experienced.

We were delayed, therefore, until July 29, before I could continue the painful journey, riding now a donkey until we reached safety. During this long detention, large flocks and herds were brought daily by the Suk to be watered at the pools near which we were camped—at the mouth of a gorge, issuing from the hills. Among the Suk who visited us was a youth who had a fairly fluent knowledge of Ki-Swahili, and from him we heard of the existence of a post at the south end of Lake Baringo, occupied by Europeans. We placed little reliance on his assertions, as we had quite made up our minds that we should have to struggle through somehow to the Ravine station, but at the same time were glad to obtain his services as guide. On starting off again, we were accompanied by him for three marches to the north-west corner of Lake Baringo. From this point he wished to take us round the east of the lake to the post, in the existence of which he persisted.

We were sceptical, so decided to proceed by the more direct route to Njemps, along the western shore of the lake. The guide asked permission to return to his father's home by the eastern route, and readily agreed to take a note, with which Major Bright supplied him, to the Baringo post. We commenced our journey along the western shores of Baringo on August 1, camped that night on the lake-shore, and continued in a southerly direction again next day. I had hoped we might find water in the river Ndo, which flows from the Kamasia range of mountains to the west into the lake. We reached the bed of this stream, amidst thick bush, some miles from the lake-shores, but found it absolutely waterless. It was now about ten, so we decided to make a short halt before proceeding in an easterly direction towards the margin of the lake. We had thought little more of the note that had been despatched; but whilst we were resting under trees, some of the men in rear reported that a white man was riding after us on a pony, accompanied by askaris, carrying small bags of flour on their heads.

The news appeared too good to be true after all the disappointments we had met with; but presently the white man was in our midst, and proved to be Mr. Hyde-Baker, the collector of the Baringo district, who conducted us to his post some 10 miles distant. A fatted ox was slaughtered for our men that night, and the poor survivors enjoyed such a meal as they had not tasted for many a weary day past. It would never be necessary now again to kill a wretched donkey for food, as Mr. Hyde-Baker could supply rations of a more congenial nature.

The extraordinary energy and dogged perseverance of Mr. Hyde-Baker had rescued us from a most desperate position. He had received the note from the Suk youth the previous day, in which our straits were clearly described, and had started an hour and a half later with a small party of men to look for us. Continuing all that day until dark, he wandered along the western shores of the lake to the north end, where he found one of our old camps. Knowing that he must have missed us, he retraced his footsteps next day, came across our tracks, and literally hunted us down until he came up with us. The debt of gratitude that we all owe to him in succouring us will not readily be forgotten.

For the next twelve days we passed a peaceful existence on the summit of an isolated hill overlooking the lake, where Mr. Hyde-Baker had established his post. The luxury of obtaining milk, eggs, and bread again was highly appreciated, and we enjoyed much hospitality besides from our host. Mr. Hyde-Baker kindly arranged to fit out a complete caravan of his own with fresh animals under charge of some twenty to thirty of his own men, in order to convey us and our stores to the railway at Lake Nakuru.

We all left Baringo post on August 14, and in due course reached the railway at Lake Nakuro on the 21st, some 75 miles distant. On August 24 we commenced our railway journey, and on the morning of the 26th reached Mombasa, covering the 450 miles in two days, which in former times used to occupy as many months marching.

We sailed from Mombasa on September 8, and on the afternoon of the 16th reached Aden. Here we remained until September 22, when we sailed again for Suez in the Austrian-Lloyd boat *Silesia*, reaching our destination on the night of September 27. The following day we journeyed by train to Cairo, where Sir Rennell Rodd and a large number of officers had most kindly come to the station to welcome back those who had passed safely through such dreadful experiences.

Two days later I accompanied the survivors of the 10th Sudanese to Assuân, where the men met with a most cordial and stirring reception, not only from their commandant and officers, but from the whole battalion, who were awaiting the arrival of the train at the station. The regimental band played them back to the lines they had left some ten months before, and the shrill lu-luing of the women intensified the emotion of those splendid fellows. Such a reception must indeed have gone far to obliterate, temporarily only perhaps, the memory of that hideous time, when they had suffered so much, and yet which they had faced with such fortitude and determination, and a firm resolve to get through at all costs. I owe those men much. Had it not been for their loyal and exemplary behaviour, and the grand way in which they worked, none of us would ever have been heard of again —alive. Having arranged with Hunter Bey all details regarding pay

etc., of the men, and bringing to his notice the names of those especially deserving of recognition, it was my sad duty to wish them all a long good-bye and return to Cairo on October 3. A week later, Major Bright, Dr. Garner, and I were on the high seas bound for England, where we arrived on October 15, 1901.

Before the reading of the paper, the PRESIDENT said: Many here present will no doubt remember the papers that were read three years ago by Colonel Macdonald and Major Austin giving a most interesting account of their very successful work, and especially of Major Austin's work along the western side of Lake Rudolf. Since that time Major Austin has been very actively employed, and he has now made a most remarkable journey, during which there were very great hardships and sufferings to be endured, from the Nile to Mombasa. I will now ask Major Austin to read his paper.

After the reading of the paper, the following discussion took place:—

Major BRIGHT: Major Austin having given you a graphic description of our journey of some 2400 miles through British territory, from Omdurman to Mombasa, I will confine myself to saying a few words on the geographical features of the country through which we passed, from the swampy regions of the Nile to the magnificent highlands of British East Africa. They are of absorbing interest. The great Abyssinian plateau, which, roughly speaking, lies north and south, bounds a large plain extending several hundreds of miles to the Nile. In this plain there are small ranges of mountains rising abruptly from the surrounding country. The natives inhabiting this region are suspicious and very shy, which is not to be wondered at, as they are constantly harried and raided by the Abyssinians. While passing through the Musha district we frequently saw the tracks of flocks and herds, and sometimes came across a few sheep and goats, but never met with a human being. We spent some time in the neighbourhood of the Omo, which is by far the finest river in this part of Africa, and the sole perpetual feeder of Lake Rudolf. Its banks are clothed with fine trees, and some parts are extensively cultivated by the natives. This is a valuable piece of country, not only for its fertility and timber, but for its supply of fresh water, that of Lake Rudolf being far from good.

As the remainder of our journey had been previously sketched by Major Austin, he here closed his survey with the most satisfactory results on his position of 1898. Observations had been taken by him nearly every night with a 5″ theodolite for latitude and time, and as we had carried with us chronometer watches, the positions of our camps were generally fixed in this way. He had mapped our route with thousands of bearings with a prismatic compass, and used pedometres with satisfactory results. The methods of azimuths and latitudes were frequently used, the former being taken from points he had fixed. The map was plotted at 4 miles to 1 inch. The heights of mountains were determined by theodolite observations from data supplied by aneroids, and thus the map you have now before you was compiled. The country on the north-west of Lake Rudolf is an open plain with a few stunted trees. The beach is composed of black sand—this is evidently the reason why it is called by the Swahilis the "Black lake"—whereas Lake Stephanie, whose shores, I have been told, are of white sand, is termed by them the "White lake." Before reaching the Turkwell river, the country becomes a dreary desert, and there are steep cliffs rising from the beach. The Turkwell has its source in the extinct crater of Mount Elgon, and is joined by the river Wei Wei, but their united waters never reach the lake, being gradually absorbed by the porous soil. Following this river

down, its bed becomes wider and wider, until all traces of it disappear. On the west are the Chemorongi mountains (a range we had crossed in 1898); they are a continuation of the Suk hills. The slopes of these last-named mountains are well watered by small streams, forming in places beautiful cascades. This country is finely timbered and cultivated, the fields being cleverly irrigated with ingeniously contrived water-channels. The valley of the Kerio river divides the Suk mountains from the Kamasia and Ribo ranges.

From here we passed through a hilly country covered with thorn bush, being fortunate enough to find the same waterholes we had used nearly four years previously. A short but steep ascent took us on to the plateau, which slopes gently down to Lake Baringo. The view from this plateau is glorious, and the air exhilarating. In all directions are ranges of mountains. At Lake Baringo we were met by Mr. Hyde Baker, who showed us the greatest kindness. Here our journey was practically at an end. We had marched over 1100 miles, and were within 80 of the Uganda railway. Too much cannot be said in praise of this wonderful piece of engineering, and of the officials who, having surmounted incredible difficulties, have completed the line to the Victoria Nyanza. If this line at some future time is extended to join the Sudan railway, the country we traversed, with the exception of the latter portion—which could be easily avoided—would present no engineering difficulties.

I cannot conclude without a tribute of esteem and affection to Mr. Garner. A better or more unselfish companion it would be hard to find, and although far from well during the last few weeks of our journey, he never spared himself in his efforts to mitigate the sufferings of the sick, and to do even more than his share of work. Our escort from the 10th Sudanese, under a native officer, Mabruk Effendi, behaved throughout the journey in a manner beyond all praise; while the transport men, suffering more than their disciplined comrades, did as well as could be expected under such trying circumstances.

Colonel WATSON: It is with some diffidence that I rise to make a few remarks, because the part of the Sudan with which I am personally acquainted lies considerably to the west of the country through which Major Austin has just made his successful journey; but I know sufficient of those places to realize, perhaps better than many who are in this room, the skill and knowledge which were necessary to enable him and Major Bright to bring so difficult a journey to so successful a conclusion. The Geographical Society owes to both these officers, and also to Dr. Garner, who so ably supported them, and perhaps without whose assistance neither Major Austin nor Major Bright would be in the room to-day, the greatest thanks for the work which they have accomplished. There is one point to which some people in the room might like attention directed. Certain people believe in the future of a Cape to Cairo railway. I have not much confidence in the idea myself, but at the same time it is interesting to know that a very considerable part of this railway will have to pass through the very difficult country which Major Austin has spoken of. My own belief is that a Cape to Cairo railway is rather a chimerical idea, and every paper I hear on the subject tends to confirm me in that view. My feeling is that any money that can be devoted to railways in Africa should rather be devoted to lines such as the admirable line which has recently been opened from Mombasa to the Victoria Nyanza. England is a maritime nation, and what we have to do is to make railway lines inland from ports on the sea-coast, and thus open up the interior—such, for instance, as the line which is now spoken of from the Red Sea to the Nile, and which ought to have been made over twenty years ago. There is one point I would like to ask Major Austin a question upon. When I was working up the Nile and surveying the river

to the north of Gondokoro, there was in this part of the country a branch river which ran in a north-easterly direction, and a very intelligent Arab who was with me expressed the opinion, which he said he had learnt from a native, that that river continued to run north-east and joined the Sobat. If so, it must have run into the Pibor, of which we heard to-night, and I should like to ask Major Austin if such a branch could run or not. I cannot help expressing the hope that on some future occasion Major Austin may go back, and instead of turning to the south-east he should just go south-west, and give us a little information of the watershed between, we will say, 7° N. and the Sobat station. There is one other point I would like information upon. Major Austin, when he was showing his views, spoke about the station at Taufikia having been founded by the late General Gordon. Well, I was up the Nile with General Gordon, and at that time we had the Sobat station in the same place as it is at present. The station of which Major Austin told us something was established by Sir Samuel Baker—a name the Geographical Society should never forget. That station was established by Sir Samuel Baker under very difficult circumstances, the river Nile being completely blocked, and he had to wait for a year; but he established the station in what he believed to be the healthiest place, and it is to me a matter of great interest to know that more than thirty years afterwards he should have been proved to be right. I will say no more except to tender my personal thanks to Major Austin for his excellent paper and to Major Bright for the assistance he has given.

Major AUSTIN: In reply to Colonel Watson's inquiries regarding the river which branches off from the Nile at Gondokoro, I think it is more than probable that it is the Pibor river in its upper waters. Very little is known of the Pibor at present, the furthest point navigated being about 7° 30′ N. Some years ago Colonel Capper proceeded up in one of the Egyptian gunboats, and he got to about 7° 30′ N., and there found that the Pibor river rose in a large area of swamp. Now, that swamp has to be filled from some other water-supply, and I think it is more than possible that the branch you describe as striking north-east is a loop, and it is quite likely that the Nile and the Sobat are connected by this loop. These loops are very common features about all that region. Two years ago Major Bright and I came across numbers of them, which, for no apparent reason, seem to leave the parent stream, and then rejoin it some distance lower down. It is quite possible, therefore, that the Nile and the Sobat are connected by the branch Colonel Watson mentions.

The PRESIDENT: I am sure we have all listened with very great interest to the account of this very remarkable journey, and what will have struck us all, I think, is, that during the severe hardships and the anxieties from the attacks of natives, and the terrible sufferings during the latter part of the journey, these officers, and especially Major Austin, should have continued to take observations regularly and with accuracy, so that he has been able to construct a valuable map of a region a portion of which is quite new. For this I think he deserves our admiration, and I am sure the meeting will wish to pass unanimously a vote of thanks to Major Austin for his paper, and also to his companion for the observations he made afterwards.

DEEP-SEA DEPOSITS AND THEIR DISTRIBUTION IN THE PACIFIC OCEAN.*

With Notes on the Samples collected by s.s. "Britannia," 1901.

By Sir JOHN MURRAY, K.C.B., LL.D., F.R.S., etc.

The foundations of our knowledge of the distribution and composition of deep-sea deposits in general may be said to have been laid by the *Challenger* Expedition, and the '*Challenger* Report on Deep-Sea Deposits,' by Sir John Murray and Prof. Renard, brings together all that was known on the subject up to the date of publication (1891). Since that time our knowledge has been greatly extended. Especially is this the case in the Pacific Ocean, where numerous soundings have been taken in connection with the Pacific cable and other Admiralty surveys, while valuable contributions have been made by the cruises of Dr. Alexander Agassiz in the United States Fish Commission steamer *Albatross*. The latest addition to our knowledge of the deposits covering the floor of the Pacific Ocean is derived from a study of the samples brought home by s.s. *Britannia*, collected by Mr. R. E. Peake, M.Inst.C.E., May to August, 1901, which forms the special subject of this paper.

Before proceeding to the description of this excellent series of samples, it seems desirable, briefly, to indicate the principal points relating to the classification, composition, and distribution of marine deposits. These have been divided into—

A.—LITTORAL DEPOSITS, found between tide-marks, and made up of boulders, gravels, sands, or muds, the composition of which is largely determined by the nature of the immediately adjacent land.

B.—SHALLOW-WATER DEPOSITS, found between low-water mark and the 100-fathoms line, made up of gravels, sands, muds, of varied composition, in some places the inorganic fragments from emerged land predominating, at other times the remains of benthonic organisms —that is, organisms living attached to, or crawling over, the sea-floor.

C.—DEEP-SEA DEPOSITS found beyond the 100-fathoms line, made up of muds, organic oozes, and clays, in which the remains of pelagic, or planktonic, organisms predominate—that is, those organisms living everywhere on or near the surface of the ocean.

The littoral and shallow-water deposits need not be further noticed here, since they are familiar and accessible. Our remarks will therefore be limited to the deep-sea deposits found in all the greater depths of the ocean outside the 100-fathoms line.

One of the principal factors in the determination of the composition of deep-sea deposits is the greater or less proximity to land. Near land the materials washed into the sea by rains and rivers, or torn from the

* Map, p. 788.

coasts by waves and currents, make up a very large proportion of the deposits. The amount of these decreases as one proceeds farther and farther seaward, and the mineral particles become smaller, until, at a distance of about 200 or 300 miles from land, the land-*débris* forms but a small proportion of the deposits,* which are there composed of materials chiefly derived from the surface waters of the open ocean, such as the shells of calcareous and siliceous organisms, and the triturated particles of floating pumice. This fact furnishes us with a means of dividing deep-sea deposits into two great classes, viz.—

1. **Terrigenous Deposits**, in which the detritus from the emerged land plays the principal part; and

2. **Pelagic Deposits**, in which the detritus derived directly from the emerged land plays only a subordinate *rôle*.

1. **The Terrigenous Deposits** comprise muds and sands, varying greatly in colour and composition, and have been subdivided into blue muds, red muds, green muds, volcanic muds, and coral muds.

(*a*) BLUE MUD.—This deposit is the one most frequently met with in the deeper waters surrounding continental land and in enclosed and partially enclosed seas. It is principally composed of materials derived from the disintegration of continental land, consisting largely of the fragments and minerals of continental rocks (the older crystalline and schisto-crystalline rocks, quartzites, sandstones, limestones) of various dimensions, but usually larger near shore and smaller as the deep sea is approached, except in those regions affected by floating ice. Quartz is the characteristic mineral species, associated with orthoclase and plagioclase felspars, green hornblende, mica, etc.; glauconite is usually present, but not in such abundance as in the green mud. There is usually a considerable proportion of amorphous clayey matter, increasing in amount with increasing distance from land, so that some of the deeper samples have a decidedly clayey aspect, but the deposit as a rule may be described as earthy rather than clayey. In some situations the remains of bottom-living organisms may be present in considerable numbers, and in others the remains of pelagic organisms may be so abundant that the deposit resembles a globigerina ooze.

(*b*) RED MUD.—This is a local variety of blue mud, hitherto known only from the Yellow sea in the Pacific, and off the Brazilian coast in the Atlantic, characterized by the presence of a large quantity of reddish ferruginous matter brought down by the large rivers in the vicinity.

(*c*) GREEN MUD.—This is a variety of blue mud, found along bold exposed coasts where no large rivers enter the sea, and distinguished by the greater or less abundance of green glauconite grains and glauconitic

* This general statement does not hold good, however, for those regions of the ocean which are seasonally or occasionally affected by icebergs and other forms of floating ice.

casts of calcareous organisms, usually associated with a greenish amorphous (probably organic) matter. In the shallower depths, the glauconitic grains and casts are sometimes associated with phosphatic concretions, while the amorphous clayey matter is less abundant, and the deposits, being more granular and more incoherent, are called GREEN SANDS.

(*d*) VOLCANIC MUDS.—This deposit occurs around oceanic islands and submarine elevations of volcanic origin, and is made up largely of volcanic rock-fragments and volcanic mineral particles, such as lapilli of basaltic and andesitic rocks, especially the vitreous varieties, sanadine, plagioclase, augite, hornblende, rhombic pyroxenes, olivine and magnetite. In the shallower waters the volcanic particles are larger, associated with less amorphous clayey matter, and the deposits, being less coherent, are called VOLCANIC SANDS. The remains of planktonic or benthonic calcareous organisms may become so abundant that it is sometimes difficult to distinguish this deposit from a globigerina ooze on the one hand, or from a coral mud or sand on the other.

(*e*) CORAL MUD.—This deposit occurs off coral islands and coral reefs, and is chiefly made up of the fragments of organisms living in the shallow waters and on the reefs, such as calcareous algæ, corals, molluscs, polyzoa, annelids, echinoderms and foraminifera. In the shallower waters near the reefs, these calcareous fragments are larger and the more finely divided calcareous matter less abundant than in the deeper waters further removed from the reefs, and the deposits are called CORAL SANDS. These deposits may contain, at times, much volcanic material.

2. **The Pelagic Deposits** are classified according to their characteristic constituents, and have been subdivided into globigerina ooze, pteropod ooze, diatom ooze, radiolarian ooze, and red clay.

(*a*) GLOBIGERINA OOZE.—This deposit is named from the predominance of the dead shells of foraminifera, which lived in the surface waters of the ocean, the genus *Globigerina* being the most characteristic, though the representatives of other genera are usually present in the tropics. Associated with the shells of pelagic foraminifera are the shells of pelagic molluscs (pteropods and heteropods), pelagic calcareous algæ (coccospheres and rhabdospheres, or their broken fragments—coccoliths and rhabdoliths), as well as the remains of calcareous organisms which habitually live on the bottom of the sea, such as molluscs, echinoderms, annelids, corals, polyzoa and bottom-living foraminifera. The remains of siliceous organisms (radiolaria, diatoms, and sponge spicules) may generally be detected, and a few small mineral particles, such as felspar, augite, hornblende, magnetite and volcanic glass, with a small quantity of clayey matter coloured by the oxides of iron and manganese. This deposit varies greatly in composition both with respect to the species of organisms present and their relative abundance, and also in the

abundance and nature of the mineral constituents. In all the great depths of the ocean, exceeding 2500 or 3000 fathoms, globigerina ooze gives place to red clay, even in those regions where pelagic foraminifera inhabit the surface waters in great profusion; this is ascribed to the longer time during which the shells are exposed to the solvent action of sea-water, while falling through the greater depth of water and while lying uncovered on the bottom.

(*b*) Pteropod Ooze.—This deposit differs from globigerina ooze only in the greater abundance of the shells of pelagic molluscs (pteropods and heteropods), and occurs characteristically at lesser depths than the globigerina ooze. Thus pteropod ooze may be said to attain its typical development at depths of 800 to 1000 fathoms, while globigerina ooze occurs typically at depths of 1500 to 2000 fathoms. The reason why the shells of pelagic molluscs are removed from the deposits sooner than the shells of pelagic foraminifera, is believed to be the larger surface which these thin and fragile shells present to the solvent action of sea-water.

(*c*) Diatom Ooze.—This deposit is distinguished by the prominence of diatom frustules, and is therefore characteristic of those regions in which these pelagic algæ swarm in the surface waters, as in the extreme northern part of the Pacific and in the far south in the neighbourhood of the Antarctic circle. The skeletons of radiolaria and the shells of one or two species of pelagic foraminifera are usually present, as well as continental mineral particles and ice-borne rock fragments, since this deposit occurs generally within the regions affected by floating ice.

(*d*) Radiolarian Ooze.—This deposit is distinguished by the abundance of the skeletons of radiolaria, and is found typically in very deep water in the tropical regions of the Pacific and Indian oceans. It is otherwise similar to the red clay next to be described, and may contain a few shells of pelagic foraminifera and small angular volcanic mineral particles, fragments of pumice, augite, felspars, hornblende, magnetite, volcanic glass frequently altered into palagonite, as well as manganese nodules, sharks' teeth, and ear-bones of cetaceans.

(*e*) Red Clay.—This deposit is the most characteristic, and probably the most widely distributed, of all deep-sea deposits over the ocean's floor, covering a very large portion of the deeper part of the Pacific. The name is sufficiently expressive of the nature and appearance of this type of deposit, there being always a considerable proportion of amorphous clayey matter, usually of a reddish colour, passing in some regions into a dark chocolate colour from the abundance of small grains of peroxide of manganese.* Usually the red clay contains very few, if any, remains of calcareous organisms, but occasionally there may be an appreciable admixture of the shells of pelagic and bottom-living foraminifera, teeth

* Whenever manganese is mentioned in these notes, the peroxide of manganese is meant.

and otoliths of fishes, fragments of echinoderms, molluscs, ostracodes, polyzoa, etc., and on approaching shallower water in tropical and temperate regions, the shells of pelagic foraminifera become more and more numerous until the red clay passes into globigerina ooze. The remains of siliceous organisms (radiolaria, diatoms, sponge spicules, arenaceous foraminifera) may generally be detected, and in some regions where the radiolarian remains become abundant, the red clay passes gradually into radiolarian ooze, while in other regions towards the far north and far south the diatom remains increase in number, and the red clay may pass insensibly into diatom ooze. Among the inorganic elements met with in red clay, the most constant and widely distributed is pumice, which occurs in larger and smaller fragments down to the most minute particles, and in all stages of disintegration and decomposition; the minerals found in pumice, like sanadine, plagioclase, augite, hornblende, magnetite, etc., are also present, along with basic volcanic glasses frequently transformed into palagonite. The peroxides of iron and manganese are universally distributed throughout the red clays, sometimes as minute grains or coatings, sometimes deposited as concretions around organic remains, pumice fragments and other nuclei, forming manganese nodules of larger or smaller size, especially where the *débris*, ashes and lapilli, of basic volcanic rocks are abundant and have undergone decomposition. These manganese nodules vary in form and size in different localities: at one place they may be large, subspherical and smooth, resembling a lot of potatoes; at another place smaller, like marbles; at another place large and spherical, but the external surfaces rough to the touch owing to the numerous mammillations; at another place flattened with one side rougher than the other, and at yet another place the nodules take the form of huge slabs. With the manganese nodules are usually associated, especially in deep water far from land, numerous teeth of sharks and ear-bones of whales, impregnated and coated more or less thickly by the peroxides of iron and manganese. In the red clays, also, numerous minute magnetic spherules, some with metallic nuclei, have been met with, and have also been extracted from the manganese nodules after these have been broken up in a mortar; these spherules are supposed to have fallen from interstellular space, and are hence called cosmic spherules. In some positions, again, there are small zeolitic crystals (phillipsite) in individuals, twins, stellate groups and spherulitic aggregations, which are supposed to be secondary products, formed *in situ*, arising from the decomposition of the basic volcanic particles present in the deposits.

All the varieties of deep-sea deposits pass, gradually, the one into the other, there being no sharp line of demarcation between them. Very frequently it is difficult to say whether a sample should be called a blue mud, a globigerina ooze, or a red clay, although typical samples of these are well marked and distinct.

Having thus briefly indicated the chief characteristics of the different types of deep-sea deposits, we may, in a few words, allude to their distribution over the floor of the Pacific ocean, as laid down approximately on an equal surface-projection hemisphere in accordance with the present state of our knowledge.

The Pacific ocean is usually looked upon as being bounded to the south by the parallel of 40° S. lat.; the great circumpolar Southern ocean lies between the parallels of 40° S. and the Antarctic circle, the Antarctic ocean being looked upon as circumscribed by the Antarctic circle. In the first instance, we will take the Pacific ocean in its limited sense—that is, as bounded on the north by the Aleutian islands; on the west by the Kurile islands, Japan, Formosa, Philippines, Gilolo, New Guinea, and the east coast of Australia; on the east by the coasts of North and South America; and on the south by the parallel of 40° S. As thus defined, the area is estimated at about 38,000,000 square geographical miles, and of this area we estimate that the red clay covers approximately about 67 per cent., the globigerina ooze about 13 per cent., the radiolarian ooze about 10 per cent., the terrigenous deposits (excluding coral mud) about 5 per cent., the diatom ooze about 2 per cent., the coral mud about 2 per cent., and the pteropod ooze about 1 per cent.

The area of the Southern ocean lying to the south of the Pacific, from the longitude of Tasmania on the west, to the South American coast and the meridian of 70° W. on the east, is estimated at about 7,750,000 square geographical miles; of this area we estimate that the globigerina ooze covers about 47 per cent., the diatom ooze about 24 per cent., the red clay about 23 per cent., and the terrigenous deposits (blue mud, etc.) 6 per cent.

The area of the Antarctic ocean lying to the south of the Pacific is estimated at about 1,300,000 square geographical miles, and this area, as far as our knowledge extends at the present time, is entirely covered by blue mud.

Taking the basin of the Pacific in its total extent (excluding, of course, the partially enclosed seas fringing its northern and western margin)—that is, from the Aleutian islands on the north to the Antarctic continent on the south, the area is estimated at about 47,000,000 square geographical miles; of this area we estimate that about 58 per cent. is covered by red clay, about 18 per cent. by globigerina ooze, about 8 per cent. by radiolarian ooze, about 8 per cent. by terrigenous deposits (excluding the coral mud), about 5 per cent. by diatom ooze, about 2 per cent. by coral mud, and about 1 per cent. by pteropod ooze.

We may now indicate the distribution of the various types of deep-sea deposits over the basin of the Pacific, treating them in the order of their importance.

(*a*) RED CLAY.—This deposit attains its most typical development

in the deep-water regions of the Pacific, covering more than one-half of the total area. It was from the central regions of the Pacific that the *Challenger* brought up the largest hauls of manganese nodules, associated with many sharks' teeth and ear-bones of whales. In the Northern Pacific it stretches from off the coast of North America to off the coasts of Japan and the Philippines, extending to the north of lat. 50° N. Separated from this area by radiolarian ooze and globigerina ooze is an area in the South Pacific which stretches across from the South American coast to the great volcanic rift lying to the east of the Samoan, Friendly, and Kermadec groups, in which depths exceeding 5000 fathoms have been obtained, extending to the south of lat. 50° S. Since the radiolarian ooze is merely a variety of red clay, it may be said that red clay (using the term to include radiolarian ooze) stretches in the Pacific from north to south through over 100° of latitude. An isolated area lies between the Fijis, Kermadecs, Norfolk island, and New Caledonia. Another isolated area lies off the east coast of Australia, and another in the deep water to the west of the New Hebrides, extending into the Coral sea.

(*b*) Globigerina Ooze.—Next in importance to the red clay is the globigerina ooze, which covers an extensive area stretching from the Coral sea and the sea surrounding the Fijis southwards to New Zealand, passing to the west and south of New Zealand uninterruptedly across the Southern ocean towards the coast of South America. There is an extensive area in the equatorial regions of the Central Pacific, surrounding Palmyra and Fanning islands, extending from long. 135° to 167° W. Globigerina ooze occurs also around all the groups of coral and volcanic islands, and on the summits or flanks of submarine elevations where the bottom rises from very deep water to depths less than 2000 fathoms.

(*c*) Radiolarian Ooze.—This type of deposit is now known to cover an extensive area of the floor of the Pacific. It has been traced from the Gulf of Panama and the coasts of Central America, between the latitudes of 5° S. and 15° N., extending through more than 80° of longitude, as far as long. 165° W. Another extensive area occurs around the Phœnix and Union groups of islands, stretching from lat. 13° S. to 8° N., and from long. 162° W. to 178° E. A smaller area occurs a little farther east, approximately between lat. 3° and 8° S., and long. 152° and 155° W. Another area occurs farther north, approximately in lat. 36° to 39° N., and long. 163° to 178° W. Radiolarian ooze also occurs between the Caroline and Ladrone groups of islands, in the region of the deepest water known on the face of the globe. Here the *Challenger's* deepest sounding in 4475 fathoms brought up a good sample of radiolarian ooze; here Dr. Alexander Agassiz sounded in 4813 fathoms, not far from Guam island, and the material brought home indicates the presence of many siliceous organisms (diatoms and

radiolaria) in the deposit; here the U.S. steamer *Nero* sounded in 5150 and 5269 fathoms (this last being the deepest sounding hitherto recorded in the ocean), and when the material comes to be examined it will probably prove that the deposit is radiolarian ooze.

(*d*) Terrigenous Deposits (excluding Coral Mud).—No attempt has been made to estimate the area of the floor of the Pacific covered by volcanic mud and green mud, as distinguished from blue mud, though we have estimated approximately the area occupied by coral mud. Around the margins of the continents of North and South America, Asia, Australia (except in the neighbourhood of the Great Barrier reef), and the Antarctic continent, the prevailing deposit is blue mud. At certain points glauconite occurs in the deposits to such an extent that they are called green muds, as off the east coast of Australia, near Sydney, off Japan, and several places along the coast of North America. Around all the oceanic islands of volcanic origin, like the Sandwich islands, New Hebrides, etc., volcanic muds occur. They are also met with in the vicinity of submarine elevations, which are the result of recent volcanic activity; several such elevations are now known in the seas around the Fijis and along the ridge extending northwards from New Zealand by the Kermadecs and Friendly islands to the Samoan group. In this region a volcanic island, to which the name of Falcon island was given, was thrown up near the Friendly islands a few years ago, but the loose volcanic scoriæ of which it was composed were gradually spread out by the action of the waves until the island became a shoal. In this region also Mr. Peake collected a sample of loose volcanic material, different from anything hitherto known from such a depth (see description of Sounding 420, p. 709).

(*e*) Diatom Ooze.—This deposit occurs typically in the Great Southern ocean surrounding the belt of blue mud bordering the Antarctic continent, and it has also been traced in a continuous band bordering the northern margin of the Pacific from off the coast of Yezo in Japan, by way of the Kurile islands, Kamtschatkan peninsula, Aleutian islands, and Alaskan peninsula, till it approaches the coast of Vancouver island.

(*f*) Coral Mud.—This deposit, as its name indicates, is associated with the coral reef region of the Pacific; it occurs along the Great Barrier reef of Australia, and off all the coral islands and coral reefs, but it is comparatively limited in its distribution, rapidly giving place on receding from the reef to volcanic mud if in the vicinity of a volcanic island, or to pteropod ooze or globigerina ooze in the case of atolls.

(*g*) Pteropod Ooze.—This type of deposit is limited in its distribution to the shallower regions of the deep sea far from continental land, and is found characteristically on the summits of submarine elevations which rise into depths less than 1000 fathoms in the tropical parts of

the great ocean basins, and in the vicinity of coral atolls outside the zone of coral mud. In the Pacific there is a considerable area in the coral reef region of the Coral sea bordering the Great Barrier reef of Australia and on the summits of the "Britannia hills," Balfour shoal,* and other elevations in the seas between Australia, New Zealand, and the Union and Ellice groups, and around some of the coral islands of the Paumotu and Marquesas groups. It will be observed that the localities mentioned are all south of the equator, and it is rather curious that we have not hitherto recognized pteropod ooze among the collections examined by us from the North Pacific, which is doubtless due to the fact that very little material is available from the moderate depths of this region.

In the preceding paragraphs we have indicated the general characters of the different types of deep-sea deposits, and their distribution throughout the basin of the Pacific ocean, and we may now proceed to deal with the samples collected by s.s. *Britannia* in 1901, which have been submitted to us by Mr. Peake for examination.

The total number of samples received is 597. The great majority of them are amply sufficient for a complete examination, but in some instances the amount of material obtained does not suffice to indicate with precision the nature of the deposit at the bottom; in other cases the material is incoherent, and appears to us to have been submitted to a certain amount of washing while being brought up to the surface.

The following table shows the distribution in depth of the 597 samples :—

90	samples	come from	depths less than 100 fathoms.
114	,,	,,	between 100 and 1000 fathoms.
206	,,	,,	,, 1000 ,, 2000 ,,
180	,,	,,	,, 2000 ,, 3000 ,,
7	,,	,,	over 3000 fathoms.
597			

The deepest sample comes from 3150 fathoms.

Of the 597 samples, 76 were insufficient to enable us to determine the type of deposit, and in 24 cases the samples were obtained on the border lines between two or three different types of deposit. For instance, six of the samples might equally well have been called red clay or radiolarian ooze, other four either red clay or globigerina ooze, other six either globigerina ooze or volcanic mud, and so on. Making allowance for these doubtful and insufficient samples, there remain 497 samples which we have been able to assign to distinct types of deposits; of these, by far the great majority are globigerina oozes, since

* See Murray, *Scott. Geo. Mag.*, vol. xiii. p. 120, 1897.

the course followed by the *Britannia* lay principally through regions of moderate depth, as will be seen from the following table:—

294	samples	are referred to	globigerina ooze.
65	,,	,,	red clay.
43	,,	,,	radiolarian ooze.
45	,,	,,	coral mud or sand.
27	,,	,,	pteropod ooze.
12	,,	,,	blue and green muds.
11	,,	,,	volcanic mud or sand.
497			

Before giving descriptions of a few of the *Britannia* soundings we may briefly refer to the deposits met with along the route followed by the s.s. *Britannia* during this cruise. Starting from Southport, New South Wales, the material brought up within the 100 fathoms line was mostly made up of fragments of mollusc shells, polyzoa, and other bottom-living organisms, with grains of quartz, mica, etc., but after crossing the 100 fathoms line, two samples of pteropod ooze were obtained from 385 and 530 fathoms, passing at 860 fathoms into globigerina ooze, which continued until the depth increased to over 2000 fathoms, where the deposit was red clay.

On approaching the "Britannia hills," the deposit was again globigerina ooze in depths less than 2000 fathoms, while pteropod ooze apparently covered the summits and upper portions of these elevations, the discovery of which forms one of the most important results of this expedition. It would have been extremely interesting to have had a good supply of the material covering the "Britannia hills" at various depths from the summits out into the deep sea, but unfortunately the shallower casts produced very little material, the snapper being frequently dented and empty. The material that did reach our hands consisted of—

(*a*) From 249 fathoms, a fragment of the arm of an ophiurid;

(*b*) From 450 fathoms, a few small fragments of corals and pteropods;

(*c*) From 478 fathoms, a good sample of pteropod ooze, which we have described;

(*d*) From 527 fathoms, a piece of volcanic rock coated with the peroxide of manganese;

(*e*) From 660 fathoms, a good sample of the deposit which might be called either globigerina or pteropod ooze, the pteropods and fragments being much less numerous than in 478 fathoms.

In greater depths the pteropod ooze passes into globigerina ooze, just as has been observed in the case of the "Balfour shoal" (already mentioned) lying further to the north. These observations indicate that the submarine elevations, which Mr. Peake has called the "Britannia hills," are fundamentally composed of volcanic rocks, which are now covered

by numerous benthonic animals, whose remains are mixed up with a considerable covering of deposits chiefly composed of the remains of pelagic or planktonic animals.

Proceeding eastwards from the "Britannia hills" the deposit is almost uninterruptedly globigerina ooze, though two samples from 2680 and 2603 fathoms approach closely in character to red clays. On approaching Norfolk island the globigerina ooze passes into pteropod ooze in depths of 300 to 700 fathoms, with coral sand in the lesser depths, the material from depths less than 100 fathoms being made up of fragments of corals and calcareous algæ, and mollusc shells. Proceeding towards New Zealand from Norfolk island, pteropod ooze is again found in depths under 900 fathoms, with globigerina ooze continuing all the way till the shallow waters surrounding New Zealand are reached. There the deposits are blue muds, while we have called two of the samples from 168 and 180 fathoms green muds, one of which will be found described in the sequel. In the shallow waters of Doubtless bay and Whangaroa bay the material is chiefly made up of broken mollusc shells with rounded pebbles.

Proceeding back to Norfolk island from New Zealand, a few soundings were taken, and then the cruise was continued from Norfolk island in a north-easterly direction towards Fiji. After crossing the zone of pteropod ooze, globigerina ooze was again encountered in depths exceeding 1000 fathoms until approaching latitude 25° S., where the globigerina ooze gradually gave place to red clay in depths over 2000 fathoms. On passing to the east of Conway reef, globigerina ooze was again met with in depths less than 2000 fathoms, the soundings over 2000 fathoms being always red clay. The depth of the boundary line between the globigerina ooze and the red clay thus varies greatly in different regions, being principally determined by the conditions at the surface. Between Conway reef and Kandavu the bottom is apparently rather irregular, the *Britannia* taking soundings in 948, 840, and 836 fathoms, separated from each other by deeper water; the deposit at the two first mentioned was globigerina ooze, while no deposit was obtained at the last mentioned, where the shot on the sounding-tube became jammed. There seemed to be indications of volcanic activity in this locality, for the samples from 1369 and 1388 fathoms contained volcanic rock fragments and minerals in some abundance, while the sample from 1491 fathoms is one of the most peculiar from so great a depth which has ever passed through our hands, consisting almost entirely of volcanic lapilli (see description, p. 709). Close to the Fijis the globigerina ooze passes in some places into pteropod ooze, in others, as on approaching Suva, into volcanic mud, with coral muds close to the reefs.

On leaving the Fijis by the Nanuku passage, the material obtained showed the presence of a good deal of manganese associated with

volcanic *débris*. The shells in the pteropod oozes from 518 and 641 fathoms were blackened by manganese; a fragment of a manganese nodule was obtained from 455 fathoms; a fragment of white calcareous tufa coated with manganese was brought up from 425 fathoms; fragments of pumice coated with manganese were obtained from 1391, 1448, 1390, 1025, 830, and 1375 fathoms.

Proceeding in a north-easterly direction towards the Samoan islands, the bottom showed some irregularities, and the soundings contained a considerable quantity of volcanic material associated with manganese; at 1390 and 1350 fathoms the deposit was globigerina ooze, containing many manganese grains; at 1269, 1190, and 1133 fathoms it was difficult to say whether the deposit should be called globigerina ooze or volcanic mud. At 900, 1150, 1126, and 1166 fathoms the deposit was volcanic mud (see description of sounding 487, p. 709). These were obtained in the vicinity of a submarine elevation covered by 400 fathoms of water, from the summit of which we received no material, but Mr. Peake says the sounding-tubes came up dented and showing a trace of manganese. Two casts of 825 and 1137 fathoms on the northern slope of this elevation procured no sample of the bottom, and the tubes came up dented, as was also the case in 1410 fathoms, a little further to the north-east.

Proceeding north-eastwards, the bottom again shoaled to 480 fathoms, the material from this cast being decomposed pumice, which had apparently formed the nucleus of a manganese nodule, and from 1510 fathoms on the eastern slope a fragment of volcanic rock coated with manganese came up jammed between the tubes, with a trace of volcanic material within the tubes. From this elevation the bottom slopes down rapidly to the north-east, being covered by red clay in depths of 2145, 2565, 2553, and 2224 fathoms. Crossing the parallel of 14° south, another elevation was met with at 1490 fathoms, the sounding-tube bringing up a fragment of a manganese nodule with nucleus of decomposed volcanic rock. The deposit at the neighbouring deep soundings was red clay, containing a good many radiolaria, which organisms increased in abundance as the passage between Savaii and the Pasco Bank was approached, and the red clay passed insensibly into radiolarian ooze. About halfway between Savaii and Pasco Bank another submarine elevation, with 1000 fathoms over it, was revealed, fragments of a pure black manganese nodule being brought up. In the deep water to the north-west the deposit was red clay or radiolarian ooze, containing many splinters of recent volcanic glass, while to the north the deposit was red clay or globigerina ooze, containing fragments of pumice impregnated with manganese. Two soundings taken to the south-east show that the slope in this direction is more gentle; we received no material from these two soundings, but Mr. Peake says that at 1433 fathoms the washer was covered by globigerina shells, and at 1590 fathoms the tubes were smeared with manganese. To the south-west,

at 2009 fathoms the tubes came up empty and dented, and at 2580 fathoms the tubes were empty, with a trace of manganese on them, while at 2553, 2568 and 2575 fathoms the deposit was radiolarian ooze. Proceeding to the north-east from this elevation, the water was found to be very deep, and the deposit at 2560 and 2549 fathoms was red clay, passing gradually at 2540 and 2528 fathoms into radiolarian ooze, which continued until, on approaching the Union group of islands, globigerina ooze was met with at depths of 2269 to 2648 fathoms. One of the samples from the border-line between these two deposits was interesting, because it showed the one type overlain by the other, the lower portion being a dark chocolate-coloured radiolarian ooze, covered by a cream-coloured globigerina ooze. In this neighbourhood manganese was met with in several of the soundings; at 2626 fathoms, Mr. Peake says, a large manganese nodule was jammed between the tubes; at 2428 fathoms the tubes were smeared with manganese, and one of them bent; at 2331 fathoms the tubes were smeared with manganese, and one of them bent; at 2548 fathoms some manganese was on the bottom of the tubes, and two of them were dented; at 2178 fathoms the sounding-tubes came up slightly dented, with trace of manganese on them, and the sounding was repeated in 2220 fathoms with snapper, which came up dented and smeared with manganese; at 2295 fathoms an elongated manganese nodule (or rather two nodules cemented together) was brought up; at 2465 fathoms the tube was kept open by a large manganese nodule; at 2808 fathoms there was a trace of manganese on the tubes; at 2875 and 2830 fathoms the tubes were smeared with manganese; at 2963 fathoms a flattish manganese nodule 4 cm. in diameter was obtained; at 2912 fathoms a small round nodule 2 cm. in diameter was brought up; at 2081 and 2290 fathoms the tubes were smeared with manganese.

On proceeding north-east from the Union group of islands the water deepened and the globigerina ooze passed again into radiolarian ooze, which occupied the sea-floor in depths of 2800 to 3150 fathoms between the equator and latitude 7° S. In the neighbourhood of the equator, although the water was still very deep, the remains of pelagic calcareous organisms became very abundant, and the deposit again changed gradually into globigerina ooze. The deposits collected, both by the *Challenger* and the *Penguin*, had already shown the presence of globigerina ooze at much greater depths under the waters of the counter equatorial current in the Pacific than in other regions of the ocean, and this is evidently due to the relatively much greater abundance of pelagic calcareous organisms in the waters of this current. The globigerina ooze continued until the zone of coral mud surrounding Fanning island was met with, and in like manner, in proceeding north-eastwards from Fanning island, globigerina ooze again covered the sea-floor until, on approaching the parallel of 8° N., the water deepened and the globigerina

ooze gave place to radiolarian ooze, fragments of manganese nodules being brought up from depths of 2425 and 2708 fathoms.

This cruise of the *Britannia* has added considerably to our knowledge regarding the depths and the distribution of the deposits in that portion of the Pacific ocean traversed by the expedition. In the first place, the discovery of the "Britannia hills," rising to within less than 300 fathoms beneath the surface, in a region where previously depths of 2500 fathoms had been observed, is a most important result. Several other submarine elevations were also revealed by the *Britannia's* soundings, especially in the seas around the Fijis, some of which have been referred to in the preceding remarks. The line of soundings run between Norfolk island and New Zealand was extremely useful in defining more accurately some of the deeper contour lines of depth, especially the 2000 fathoms line. The line of soundings between the Union group and Fanning island was also extremely useful in defining the 3000 fathoms line, which had been previously laid down in this region much farther to the east.

As regards the additions to our knowledge of the deposits, pteropod ooze must now be introduced on the summits of the "Britannia hills," and on the borders of the blue mud area off the Australian coast. The *Britannia* samples also show that a zone of pteropod ooze surrounds the coral mud area around Norfolk island. The two samples of green mud from off the north-east coast of New Zealand are also interesting, as glauconite had not previously been observed in any abundance in this locality. In the passage between Pasco bank and Savaii, radiolarian ooze was met with farther south than had been previously recorded.

Appended are detailed descriptions of a few of the more typical and interesting samples, according to the plan adopted in the '*Challenger* Report on Deep-Sea Deposits.' In the examination of these deposits, and in the preparation of these notes for publication, I have to acknowledge the continuous assistance of Mr. James Chumley and Mr. Robert Dykes.

Sounding 11.—May 18, 1901, lat. 28° 3′ 2″ S., long. 154° 1′ 59″ E., 385 fathoms.

Pteropod Ooze, brownish grey, coherent, plastic, granular; containing—

(*a*) Calcium Carbonate (64·06 per cent.), made up of pteropods and heteropods and fragments, pelagic foraminifera (including *Globigerina bulloides*, *G. sacculifera*, *G. conglobata*, *G. dubia*, *G. rubra*, *G. æquilateralis*, *Sphæroidina dehiscens*, *Orbulina universa*, *Pullenia obliquiloculata*, *Pulvinulina menardii*, *P. tumida*, *P. canariensis*, *P. micheliniana*), bottom-living foraminifera (including *Biloculina*, *Spiroloculina*, *Nodosaria*, *Uvigerina*, *Cassidulina*, *Anomalina*, *Cristellaria*), echini spines, ostracodes, otoliths of fishes, tunicate spicules, coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (35·94 per cent.), grey-brown, consisting of—

(1) *Minerals* (15 per cent.), mean diameter 0·15 mm., angular, including quartz, mica (muscovite), felspar, hornblende, volcanic glass, magnetite;

(2) *Siliceous organisms* (7 per cent.), including sponge spicules, arenaceous foraminifera, clayey casts of calcareous organisms;

(3) *Fine washings* (13·94 per cent.), made up of amorphous clayey matter, together with minute particles of minerals and siliceous organisms.

Sounding 32.—May 28, 1901, lat. 28° 12′ 39″ S., long. 155° 35′ 29″ E., 478 fathoms. **Pteropod Ooze**, creamy white, plastic, coherent; containing—

(*a*) Calcium Carbonate (88·76 per cent.), made up of pteropods (including *Clio subula*, *C. australis*, *Cavolinia*), heteropods (*Atlanta*), pelagic foraminifera (including *Globigerina bulloides*, *G. conglobata*, *G. æquilateralis*, *G. rubra*, *G. dubia*, *G. sacculifera*, *Candeina nitida*, *Pullenia obliquiloculata*, *Pulvinulina menardii*, *P. tumida*, *P. micheliniana*, *P. canariensis*, *Orbulina universa*, *Sphæroidina dehiscens*), bottom-living foraminifera (including *Biloculina*, *Uvigerina*, *Nodosaria*, *Amphistegina*), ostracodes, otoliths, echini spines, larval lamellibranchs and gastropods (*Pleurotoma*), coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (11·24 per cent.), brown, consisting of—

(1) *Minerals* (3 per cent.), mean diameter 0·1 mm., angular, including felspar, volcanic glass, magnetite;

(2) *Siliceous organisms* (1 per cent.), only sponge spicules observed;

(3) *Fine washings* (7·24 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of sponge spicules.

Sounding 43.—May 31, 1901, lat. 27° 51′ S., long. 155° 54′ 30″ E., 2676 fathoms. **Red Clay**, mottled white and grey, plastic, coherent; containing—

(*a*) Calcium Carbonate (21·13 per cent.), made up of broken pelagic foraminifera (including *Globigerina æquilateralis*, *G. conglobata*, *Sphæroidina dehiscens*), coccoliths and rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (78·87 per cent.), grey brown, consisting of—

(1) *Minerals* (3 per cent.), mean diameter 0·07 mm., angular, including felspar, augite, hornblende, volcanic glass;

(2) *Siliceous organisms* (2 per cent.), including radiolaria and sponge spicules;

(3) *Fine washings* (73·87 per cent.), amorphous clayey matter, with a few minute mineral particles and fragments of siliceous organisms.

Sounding 61.—June 2, 1901, lat. 28° 29′ 4″ S., long. 155° 1′ 24″ E., 2488 fathoms. **Red Clay**, dark grey, unctuous; containing—

(*a*) Calcium Carbonate (17·57 per cent.), made up of fragments of pelagic and bottom foraminifera, echini spines, coccoliths (some very large);

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (82·43 per cent.), dirty grey, consisting of—

(1) *Minerals* (5 per cent.), mean diameter 0·07 mm., angular, including augite, mica, felspar, hornblende, magnetite, and volcanic glass. Many small black spherules unaffected by hydrochloric acid and non-magnetic were observed, the nature of which is uncertain.

(2) *Siliceous organisms* (3 per cent.), including sponge spicules, radiolaria, diatoms, fragments of arenaceous foraminifera.

(3) *Fine washings* (74·43 per cent.), made up of amorphous clayey matter, together with minute mineral particles and fragments of siliceous organisms.

Sounding 102.—June 7, 1901, lat. 28° 53′ S., long. 160° 14′ E., 1290 fathoms.
Globigerina Ooze, rose or cream colour, granular; containing—

(*a*) Calcium Carbonate (82·57 per cent.), made up of pelagic foraminifera (including *Orbulina universa, Globigerina conglobata, G. bulloides, G. dubia, G. sacculifera, G. rubra, G. æquilateralis, G. inflata, Pulvinulina micheliniana, P. canariensis, P. crassa, Pullenia obliquiloculata, Sphæroidina dehiscens*), bottom-living foraminifera, fish teeth, coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (17·43 per cent.), brown, consisting of—

(1) *Minerals* (1 per cent.), mean diameter 0·06 mm., rounded, including augite, felspar, &c.;

(2) *Siliceous organisms* (2 per cent.), including sponge spicules, arenaceous foraminifera, radiolaria.

(3) *Fine washings* (14·73 per cent.), made up of amorphous clayey matter, together with minute particles of minerals and siliceous organisms.

Sounding 114.—June 8, 1901, lat. 28° 49′ 15″ S., long. 162° 17′ 30″ E., 748 fathoms.
Globigerina Ooze, cream colour, soft and plastic, coherent; containing—

(*a*) Calcium Carbonate (82·65 per cent.), made up of pelagic foraminifera (including *Globigerina bulloides, G. conglobata, G. æquilateralis, G. rubra, G. dubia, G. sacculifera, Orbulina universa, Sphæroidina dehiscens, Pullenia obliquiloculata, Pulvinulina menardii, P. tumida, P. canariensis, P. micheliniana, Hastigerina*), bottom-living foraminifera (including *Pullenia sphæroides, P. quinqueloba, Nodosaria, Uvigerina, Biloculina, Amphistegina*), ostracodes, otoliths of fish, echini spines, coccoliths, rhabdoliths, and coccospheres;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (17·35 per cent.), brown in colour, consisting of—

(1) *Minerals* (2 per cent.), mean diameter 0·07 mm., angular, including felspar, hornblende, volcanic glass, magnetite;

(2) *Siliceous organisms* (3 per cent.), including radiolaria, arenaceous foraminifera, small sponge and sponge spicules, diatoms;

(3) *Fine washings* (12·35 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of siliceous organisms.

Sounding 155.—June 14, 1901, lat. 28° 58′ 52″ S., long. 167° 40′ E., 600 fathoms.
Pteropod Ooze, greyish brown, coherent; containing—

(*a*) Calcium Carbonate (87·12 per cent.), made up of pteropods (including *Clio subula, C. australis*), heteropods (*Atlanta, Carinaria*), pelagic foraminifera (including *Globigerina bulloides, G. conglobata, G. æquilateralis, G. sacculifera, G. rubra, Sphæroidina dehiscens, Pullenia obliquiloculata, Orbulina universa, Pulvinulina canariensis, P. crassa, P. micheliniana*), bottom-living foraminifera (including *Nodosaria, Cristellaria, Pullenia bulloides, Uvigerina, Biloculina, Cassidulina*), alcyonarian spicules, tunicate spicules, echini spines, otoliths of fishes, ostracodes, larval molluscs, polyzoa, coccoliths, rhabdoliths, coccospheres;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (12·88 per cent.), brown, consisting of—

(1) *Minerals* (2 per cent.), mean diameter 0·1 mm., angular, including felspar, augite, hornblende, muscovite, volcanic glass, magnetite;

(2) *Siliceous organisms* (1 per cent.), including sponge spicules, radiolaria, diatoms;

(3) *Fine washings* (9·88 per cent.), made up of amorphous clayey matter, together with minute mineral particles and fragments of siliceous organisms.

Sounding 246.—June 25, 1901, lat. 31° 6′ 49″ S., long. 170° 3′ 44″ E., 2034 fathoms.
Globigerina Ooze, pure white with light brown patches, chalky, coherent; containing—

(*a*) Calcium Carbonate (88·86 per cent.), made up of small pelagic and bottom-living foraminifera and fragments, pteropod fragments, coccoliths, rhabdoliths, coccospheres;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (11·14 per cent.), grey, consisting of—

(1) *Minerals* (1 per cent.), mean diameter 0·07 mm., angular, a few glassy particles;

(2) *Siliceous organisms* (2 per cent.), including fragments and spicules of siliceous sponges, fragments of arenaceous foraminifera, radiolaria;

(3) *Fine washings* (8·14 per cent.), made up of amorphous clayey matter, with a few minute mineral particles and siliceous fragments.

Sounding 295.—July 6, 1901, lat. 34° 36′ 32″ S., long. 173° 35′ 37″ E., 180 fathoms.
Green Mud or Sand, greenish grey, incoherent, gritty; containing—

(*a*) Calcium Carbonate (30 per cent.), made up of pelagic and bottom foraminifera, echini spines, one or two pteropod fragments, tunicate spicules, coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (70 per cent.), green, consisting of—

(1) *Minerals* (40 per cent.), mean diameter 0·2 mm., angular and rounded, including quartz, mica, glauconite, felspar, volcanic glass;

(2) *Siliceous organisms* (10 per cent.), including glauconitic casts, sponge spicules, arenaceous foraminifera, diatoms;

(3) *Fine washings* (20 per cent.), made up of amorphous clayey matter and many minute particles of minerals and siliceous organisms.

Sounding 297.—July 13, 1901, lat. 34° 29′ 30″ S., long. 173° 36′ 57″ E., 465 fathoms.
Globigerina Ooze, greyish brown, granular, coherent; containing—

(*a*) Calcium Carbonate (40 per cent.), made up of small pelagic foraminifera (including *Globigerina bulloides, G. conglobata, G. æquilateralis, G. dubia, Sphæroidina dehiscens, Pulvinulina micheliniana, P. canariensis, Orbulina universa*), bottom-living foraminifera (*Nodosaria, Uvigerina, Biloculina*), ostracodes, otoliths of fishes, echini spines, coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (60 per cent.), brownish grey, consisting of—

(1) *Minerals* (15 per cent.), mean diameter 0·1 mm., angular, including pumice, volcanic glass, hornblende, muscovite, felspar, augite, magnetite;

(2) *Siliceous organisms* (5 per cent.), including clayey casts, sponge spicules, arenaceous foraminifera;

(3) *Fine washings* (40 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of siliceous organisms.

Sounding 340.—July 20, 1901, lat. 26° 32′ 18″ S., long. 170° 49′ 10″ E., 2290 fathoms.
Globigerina Ooze, light brown, plastic, coherent; containing—

(*a*) Calcium Carbonate (65·59 per cent.), made up of small and broken pelagic foraminifera (including *Globigerina bulloides, G. conglobata,*

G. æquilateralis, G. dubia, G. inflata, G. sacculifera, Sphæroidina dehiscens, Orbulina universa, Pullenia obliquiloculata, Pulvinulina micheliniana, P. canariensis), bottom-living foraminifera (including *Lagena, Uvigerina, Nodosaria*), echini spines, ostracodes, coccoliths and rhabdoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (34·41 per cent.), reddish brown, consisting of—

(1) *Minerals* (5 per cent.), mean diameter 0·15 mm., including orthoclastic and other felspars, pumice (one fragment measuring 2 mm. in diameter), clear, brown, and green volcanic glass, brown hornblende, magnetite;

(2) *Siliceous organisms* (2 per cent.), including radiolaria, sponge spicules, arenaceous foraminifera, diatoms;

(3) *Fine washings* (27·41 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

SOUNDING 359.—July 22, 1901, lat. 24° 23′ 24″ S., long. 173° 4′ 51″ E., 2475 fathoms.

Red Clay, dark, reddish brown, plastic, coherent; containing—

(*a*) CALCIUM CARBONATE (10·35 per cent.), made up of broken pelagic foraminifera (*Sphæroidina dehiscens*, etc.), coccoliths and rhabdoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (89·65 per cent.), brown, consisting of—

(1) *Minerals* (15 per cent.), mean diameter 0·15 mm., angular, including pumice, volcanic glass, felspar, hornblende, magnetite;

(2) *Siliceous organisms* (3 per cent.), including radiolaria, arenaceous foraminifera, sponge spicules;

(3) *Fine washings* (71·65 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of siliceous organisms.

SOUNDING 367.—July 23, 1901, lat. 23° 26′ 59″ S., long. 174° 11′ 28″ E., 2340 fathoms.

Red Clay, chocolate coloured, plastic; containing—

(*a*) CALCIUM CARBONATE (4·10 per cent.), made up of fragments of pelagic and bottom-living foraminifera, coccoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (95·90 per cent.), chocolate coloured, consisting of—

(1) *Minerals* (40 per cent.), mean diameter 0·18 mm., angular, consisting principally of fragments of pumice (one piece measuring 3 mm. in diameter), felspar, glassy particles.

(2) *Siliceous organisms* (3 per cent.), including radiolaria, sponge spicules, arenaceous foraminifera;

(3) *Fine washings* (52·90 per cent.), made up of amorphous clayey matter with minute splinters of pumice and fragments of siliceous organisms.

SOUNDING 331.—July 24, 1901, lat. 21° 55′ 17″ S., long. 175° 29′ 38″ E., 1599 fathoms.

Globigerina Ooze, greyish brown, plastic, coherent; containing—

(*a*) CALCIUM CARBONATE (73·99 per cent.), made up of pelagic foraminifera (including *Globigerina bulloides, G. conglobata, G. æquilateris, G. dubia, G. rubra, Sphæroidina dehiscens, Pullenia obliquiloculata, Pulvinulina tumida, P. menardii, P. micheliniana, P. canariensis, Orbulina universa, Candeina nitida*), bottom-living foraminifera (including *Biloculina, Uvigerina*), ostracodes, coccoliths, rhabdoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (26·01 per cent.), reddish brown, consisting of—

(1) *Minerals* (5 per cent.), mean diameter 0.15 mm., angular, including pumice, felspar, volcanic glass, magnetite;

(2) *Siliceous organisms* (1 per cent.), including sponge spicules, radiolaria;

(3) *Fine washings* (20·01 per cent.), made up of amorphous clayey matter, with minute mineral particles and fragments of siliceous organisms.

SOUNDING 420.—July 28, 1901, lat. 19° 36′ 11″ S., long. 177° 17′ 23″ E., 1491 fathoms.

Volcanic Lapilli. The material consists of coarse, angular fragments of greyish black volcanic rock and obsidian; the rock fragments, the largest of which measures 15 × 12 × 3 mm., are vesicular, light in weight, and contain felspar and magnetite crystals set in a glassy base. There are also larger and smaller isolated crystals of augite, with well-defined faces. A few pelagic foraminifera were also observed (including *Globigerina conglobata, G. æquilateralis, G. bulloides, G. dubia, Sphæroidina dehiscens, Orbulina universa, Pulvinulina tumida, P. canariensis, P. micheliniana*).

It is possible that any fine amorphous clayey matter associated with this volcanic scoriæ at the bottom may have been washed out of the sounding-machine while being drawn up to the surface.

SOUNDING 441.—July 29, 1901, lat. 18° 10′ 35″ S., long. 178° 23′ 49″ E., 159 fathoms.

Pteropod Ooze, bluish grey, soft, plastic, coherent; containing—

(*a*) CALCIUM CARBONATE (48·27 per cent.), made up of pteropod fragments (including *Clio subula, C. australis*), pelagic foraminifera (including *Globigerina bulloides, G. conglobata, G. æquilateralis, Sphæroidina dehiscens, Orbulina universa*), echini spines, larval mollusc shells, bottom-living foraminifera (*Biloculina*, etc.), ostracodes, otoliths of fish, coccoliths, rhabdoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (51·73 per cent.), greenish blue, consisting of—

(1) *Minerals* (10 per cent.), mean diameter 0·1 mm., angular, including felspar, augite, hornblende, volcanic glass, magnetite;

(2) *Siliceous organisms* (3 per cent.), including sponge spicules, arenaceous foraminifera;

(3) *Fine washings* (38·73 per cent.), made up of amorphous clayey matter with minute particles of minerals and siliceous organisms.

SOUNDING 487.—August 6, 1901, lat. 15° 11′ 4″ S., long. 176° 45′ 6″ W., 900 fathoms.

Volcanic Mud, brown, granular, coherent; containing—

(*a*) CALCIUM CARBONATE (21·03 per cent.), made up of pelagic foraminifera (including *Globigerina bulloides, G. conglobata, G. æquilateralis, G. sacculifera, G. dubia, Sphæroidina dehiscens, Orbulina universa, Pulvinulina menardii, P. tumida, P. canariensis*), bottom-living foraminifera (*Pullenia sphæroides, Lagena*, etc.), echini spines, otoliths of fish, ostracodes, coccoliths, rhabdoliths;

(*b*) RESIDUE, after removal of calcium carbonate by dilute hydrochloric acid (78·97 per cent.), heavy, brown in colour, with black vitreous particles, consisting of—

(1) *Minerals* (45 per cent.), mean diameter 0·3 mm., angular, including volcanic glass, felspar, pumice, magnetite;

(2) *Siliceous organisms* (2 per cent.), made up of arenaceous foraminifera, radiolaria;

(3) *Fine washings* (31·97 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

Sounding 495.—August 6, 1901, lat. 14° 32′ 36″ S., long. 175° 55′ 10″ W., 1281 fathoms.

Globigerina Ooze, reddish brown, consolidated into small lumps, perforated by worms, the perforations darker brown in colour. Mr. Peake says that the material came up perfectly hard and dry, and required a hammer to knock it out of the tubes; the space between the tubes was quite full, and apparently riddled with what looked like worm-holes; but on attempting to take off the sample it fell to pieces. It contains—

(*a*) Calcium Carbonate (40·59 per cent.), made up of pelagic foraminifera, mostly of small size, bottom-living foraminifera, coccoliths, rhabdoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (59·41 per cent.), dark brown, consisting of—

(1) *Minerals* (25 per cent.), mean diameter 0·2 mm., mostly angular, including augite (one crystal 3 mm. in maximum diameter and smaller ones observed), hornblende, magnetite, felspar, volcanic glass, pumice;

(2) *Siliceous organisms* (1 per cent.), a few sponge spicules;

(3) *Fine washings* (33·41 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

Sounding 510.—August 8, 1901, lat. 13° 35′ 0″ S., long. 174° 13′ 30″ W., 2530 fathoms.

Red Clay or Radiolarian Ooze, brown with darker patches, clayey, gritty; containing—

(*a*) Calcium Carbonate (27·5 per cent.), made up of pelagic foraminifera and fragments, bottom foraminifera, echini spines, fish teeth, coccoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (72·5 per cent.), brown, consisting of—

(1) *Minerals* (25 per cent.), mean diameter 0·2 mm., angular, principally fragments of pumice (several fragments measuring 2 mm. in diameter, and one exceeding 5 mm. observed), felspar, volcanic glass, magnetite;

(2) *Siliceous organisms* (10 per cent.), including radiolaria, sponge spicules, arenaceous foraminifera;

(3) *Fine washings* (37·5 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

Sounding 581.—August 17, 1901, lat. 3° 52′ 26″ S., long. 166° 7′ 46″ W., 2945 fathoms.

Radiolarian Ooze, chocolate colour, plastic, coherent; containing—

(*a*) Calcium Carbonate (2 per cent.), made up of fish teeth, coccoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (98 per cent.), chocolate colour, consisting of—

(1) *Minerals* (3 per cent.), mean diameter 0·1 mm., angular, including pumice (one fragment 10 mm. in diameter), volcanic glass, felspar, magnetite, hornblende;

(2) *Siliceous organisms* (40 per cent.), including radiolaria, sponge spicules, diatoms;

(3) *Fine washings* (55 per cent.), made up of amorphous clayey matter, with fragments of siliceous organisms and minute mineral particles.

Sounding 625.—August 25, 1901, lat. 3° 53′ 46″ N., long. 159° 24′ 45″ W., 255 fathoms.

Coral Sand, greyish white, granular, incoherent; containing—

(*a*) Calcium Carbonate (98·55 per cent.), made up of angular fragments of corals and mollusc shells, polyzoa, *Orbitolites*, *Serpula*, echini spines, larval gastropods and lamellibranchs, alcyonarian spicules, tunicate spicules, otoliths of fish, ostracodes, bottom-living foraminifera (*Biloculina*, *Polytrema*, *Amphistegina*, *Pullenia sphæroides*, etc.), pelagic foraminifera (including *Globigerina bulloides*, *G. conglobota*, *G. sacculifera*, *G. æquilateralis*, *Sphæroidina dehiscens*, *Pullenia obliquiloculata*), pteropod fragments (*Clio subula*), heteropods (*Atlanta*);

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (1·45 per cent.), brown, consisting of a few grains of felspar and volcanic glass, one or two sponge spicules, and a very little amorphous clayey matter.

Sounding 664.—August 30, 1901, lat. 8° 15′ N., long. 157° 7′ 50″ W., 2760 fathoms.

Radiolarian Ooze, brown, plastic, coherent; containing—

(*a*) Calcium Carbonate (20·99 per cent.), made up of broken pelagic and bottom foraminifera, echini spines, coccoliths;

(*b*) Residue, after removal of calcium carbonate by dilute hydrochloric acid (79·01 per cent.), brown, consisting of—

(1) *Minerals* (2 per cent.), mean diameter 0·1 mm., angular, including volcanic glass, felspar, hornblende, magnetite;

(2) *Siliceous organisms* (30 per cent.), including radiolaria, sponge spicules, arenaceous foraminifera, diatoms;

(3) *Fine washings* (47·01 per cent.), made up of amorphous clayey matter, with minute particles of minerals and siliceous organisms.

FROM THE YANG-TSE KIANG TO THE CHINA SEA.*

By WM. BARCLAY PARSONS, C.E.

The Chinese Empire has never been completely and accurately surveyed, although native maps exist purporting to give a delineation of the whole country. While such sources of information are sufficiently approximately correct to show the geography and the topography for ordinary purposes, it is only as surveys are made under foreign auspices that we are enabled to get the true location and description of details. Such foreign surveys naturally follow the trade routes—that is, the coast-line and inland waters. When the latter have all been correctly plotted we shall have secured the topographical skeleton, to which the less important details can be readily connected. This paper, with its accompanying map, gives a description of two important waterways which hitherto have never been accurately surveyed.

Of the primary lines of drainage of China there are three, all of

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* Map, p. 788.

which have an easterly course, draining as they do the eastern flank of the Asiatic upheaval. These rivers are—the Si (West) river in the south; Yang-tse in the centre; and the Hoang (Yellow) in the north. The largest and in every way the most important of the above is the Yang-tse, which includes within the limits of its watershed more than one-half of the area of the empire proper. The Yang-tse itself has been described so often and so minutely from its upper waters to the sea that all description of it will be omitted here except to recall that its length is about 3500 miles, with a width at the mouth of 7 miles, and that it is navigable for steam-vessels as far as I-chang, 1100 miles, and for ocean-going vessels for 700 miles, as far as Hankau. The author is aware that a steam-launch has been taken 500 miles above I-chang, as far as Chung-king, through the energy of Mr. Little, but not wholly so under her own steam, as the united strength of several hundred coolies was necessary to tow her up the rapids, and more recently the experiment has been repeated with a flat-bottomed British gunboat. Whether or not the Yang-tse above I-chang can ever be improved so that it will be a navigable stream is a question still unanswered. The greatest traffic to and from Hankau is during the summer, when tea is being shipped, and during which season the depth of water ranges from 30 to 50 feet, according to the condition of the flood. The minimum stage of the river occurs usually in December, when a draught of about 11 feet is all that can be counted on below Hankau.

The Yang-tse has three important tributaries—the Kan, the one nearest the sea, draining the province of Kiang-si, and flowing into the Yang-tse through the Po-yang lake at Kiu-kiang, 520 miles from the sea. The next tributary is the Han, flowing south into the Yang-tse at Hankau (literally Han-mouth), draining portions of the provinces of Hu-peh, Shen-si, and Ho-nan. Proceeding westerly, the next tributary is the Siang, a river second in importance only to the Han, flowing from south to north, and joining the great river at the Tung-ting lake 150 miles above Hankau, or about 850 miles from the sea, following the sinuosities of the Yang-tse. It is with the Siang-kiang and its chief tributary, the Lei-ho, and the Pei-ho and its tributary the Wu-shwei on the south side of the Nanling range which separates the Yang-tse drainage from that of the China sea, that this paper will deal.

From time immemorial the Kan and the Siang rivers, with the Pei-ho, have constituted the chief highways between south and central China. Canton is to-day, and always has been, the seat of manufacturing industry, so that the term "Canton article" has become synonymous with "manufactured article." Canton has also been China's chief gateway for external trade. It was from Canton, long before the days of Marco Polo, that venturesome traders are supposed to have sailed around India, and so to have carried silk to Europe. Even at the present time,

of all Chinese the Cantonese are the shrewdest traders and the greatest travellers. Between such a point and other parts of the empire direct and reasonably easy communication was necessary. Three routes presented themselves, of which two had a common stem at the south end in the Pei-ho (North river) from Canton to Shao-chau, while the third followed the Si-kiang (West river) to Wu-chau, and thence the Kiu kiang northward. From Shao-chau the easternmost of the three routes lay along the Pei-ho to the Nanling range, which last named was crossed by a portage over the Meling pass. On the north side of the range the waters of the Kan-kiang were reached, and were followed to the Po-yang lake and thus to the Yang-tse. This was the route usually

DESCENT FROM CHELING PASS TOWARDS CHINA SEA.

taken in going from Canton to Peking; for from Kiu-kiang it was a short and easy journey by the way of the Yang-tse to Yang-chau, the southern terminus of the Grand canal. It was by this route that the celebrated embassy, headed by Lord MacCartney, journeyed in 1793 from Peking to Canton. The most western of the three routes crossed the Nanling range at a point where the range is so low that a canal has been constructed connecting the waters of the valley of the West river with those of the Siang.

The central route, known as the Cheling, is the most important. This route follows the Wu-shwei, a tributary of the Pei-ho, from Shao-chau to the head of small boat navigation at I-chang (not to be confounded with I-chang at the head of steam navigation on the Yang-tse),

whence there has been constructed a paved highway leading over the range *viâ* the Cheling pass to Cheng-chau, at the head of navigation on the Lei-ho. As the last is a branch of the Siang, the Cheling leads directly to the Yang-tse and Central China. The length of the highway is about 90 Chinese "li," or 30 English miles, with an elevation of about 750 feet to overcome. Of the three routes, the Cheling has undoubtedly carried the greatest traffic, on account of the better outlet to the north and of its superior water facilities, the Siang being a larger and more easily navigated stream than the Kan. The time when this route was first established, or when and how the highway was first laid out and paved, is quite uncertain. Undoubtedly it is of great antiquity. As a mere trade route, it is probably coeval with the first exchange of commodities between the Yang-tse valley and the region of the China sea. Then, as traffic grew, the land portage was paved, houses for the entertainment of travellers, and for the housing of pack-coolies and ponies, were established. Such houses were, for convenience and mutual protection, grouped into detached villages, and finally these villages grew together, so that the highway became lined with inns, shops, and stables almost continuously from end to end. During the two, three, or more thousand years of the existence of this route an enormous tonnage, both north and south, has passed over it. With the opening of the Yang-tse to steam navigation in 1860, the glory of the Cheling highway began to fade, as it was found more profitable to ship goods between central China and Canton by way of the Yang-tse and the ocean, so that to-day, although the traffic is still considerable, many of the buildings that were once necessary to supply the needs of the traveller or the coolies are now abandoned and are dropping to decay. Curiously enough, in spite of its importance as a trade factor, but little in the way of accurate information has been known of it, and that little has come chiefly from native sources. This lack of information is owing to the peculiarity of the people living in Hu-nan, the province immediately to the north of the mountains. In this province the Chinese characteristic of exclusiveness has reached its maximum development, so that foreigners have been prevented from entering it. In fact, this spirit of exclusiveness has been so strong that even Chinese other than those of Hu-nanese origin have not been welcome, so that in my recent journey about to be described considerable difficulty was experienced in getting Chinese attendants. On this account Hu-nan has earned the title of the "closed province," and Chang-sha, its capital, has divided honours with Lhasa in Tibet as never having been polluted by the presence of a "foreign devil." Attempt after attempt has been made by missionaries to gain a lodgment in Hu-nan, but always ineffectually, except in the north-western corner, where the people are more kindly disposed, and in the southern part at Heng-chau, where, singular to state, a Roman Catholic post was established nearly two hundred years ago, and which since

then has successfully withstood many an attack, receiving reinforcement from time to time by boat up the Siang.

For maps and geographical knowledge on this interesting and important section of China we have had to depend on Chinese surveys, which, it is almost needless to add, are quite inaccurate and incomplete. No thorough or accurate survey has been made previous to the one of which this paper is the record. Four careful observers have been over the route in whole or part, but, their journeys having been confined to boat travel, they noted those things only which could be examined from a moving junk. Dickson, in 1861, was the first foreign traveller to go from Canton to the Yang-tse; and was followed by Raphael Pumpelly, an American geologist, who in 1865 endeavoured to explore the Siang valley, but who, on reaching Chang-sha, was forced to return without having been permitted to land. In 1869 the Chamber of Commerce of Shanghai commissioned Baron Richthofen, the celebrated German geologist, to examine the province of Hu-nan with special respect to its coalfields. Von Richthofen started at Canton, went northward over the Cheling, and then continued his course along the Siang and its tributaries until he reached the Yang-tse. Like Pumpelly, he was forbidden to go ashore. In 1878 Mr. G. J. Morrison, an English engineer, started from Hankau to explore Hu-nan on foot. On reaching the borders of the province, the officials insisted on his embarking on a junk, by which means he continued southward, finally reaching Canton. The observations of these travellers have been recorded, those of the last through a paper read before the Royal Geographical Society. Their records, however, were necessarily approximate and incomplete.

At the close of the year 1898, the writer, with a properly equipped staff, started from Hankau to make a continuous instrumental survey along the Cheling route to Canton, in order to determine its suitability for railroad purposes. This, in spite of difficulties, urged by the Chinese and seconded by the foreigners, was successfully accomplished, thus completing the first land journey. The survey line as run was 742 miles in length, in addition to which reconnaissance work covered about 400 miles more. Of the total distance, at least 500 miles were through a district where no foreigner had ever been seen, and an entrance into and an official reception in Chang-sha were obtained. The survey itself was the longest survey hitherto completed in the Chinese Empire. Measurements were made by means of a tacheometer transit, with a vertical circle and solar compass attachment, so that angles in azimuth and altitude were measured, determining horizontal distances and altitudes. By means of the solar compass the variation of the magnetic needle was frequently measured. The determination of the position of the line of zero magnetic variation was a matter of special interest, in order to get a suggestion as to its probable trace across China. The survey began from the known longitude and latitude at Hankau, and

closed on that of Canton. The final error was about half a mile, or an error of 1 in 1500, a much closer result than could be obtained with a chain.

The course of our journey passed through three provinces, Hu-peh in part, the length of Hu-nan, and across Kwang-tung from its northern boundary to Canton. Hu-peh, so far as this paper is concerned, will be passed over with a few remarks. The Yang-tse kiang has been already surveyed and mapped, and the province of Hu-nan has been quite fully explored. The survey herein described, so far as it relates to Hu-peh, will suffice to locate a chain of lakes that is to be found between the Yang-tse and a range of hills that runs parallel with the Yang-tse 10 to 15 miles away. These lakes and the scattering villages have been shown only on Chinese maps, and then, as we found more than once to our great discomfort, sometimes very far from their true location.

From Hankau to the Tung-ting lake the banks of the Yang-tse preserve the same general characteristics that prevail between the sea and Hankau, viz. a plain on the north or left bank, and a broken surface on the south. The annual rise of the river at Hankau varies from 40 to 50 feet, a rise sufficient to top the banks at nearly all points west of Hankau. To prevent lands from being overflowed, the several localities are organized into districts in order that the inhabitants may unite to construct dykes to protect their common interests. These dykes are very irregular in plan, but in cross-section have a width on top of 6 to 10 feet, side slopes of about two horizontal to one vertical, and a height as great as 15 feet at times, though the average seemed to be about 8 feet. As a general thing, they are not paved or revetted on the slopes. Along this part of its course the Yang-tse resembles the Mississippi and other alluvium-carrying streams, in that it builds up its banks. The highest land was frequently found next to the river, whence it falls inland at a rate in some places as great as 1 in 125, or 1 in 100, until a range of hills is reached 10 or 15 miles south of the river-bank. Wherever the dykes fail, or the flood waters can get around them, the back lands are therefore more deeply flooded than those next to the river. For this reason the main highway has been constructed along the sides of the hills well above the level of the low lands.

The chief crop raised in this section is rice, which is consumed mostly at home. Other products are beans, cotton of coarse and short staple, and bean oil. Bricks are manufactured. Coal is found, but, on account of the high proportions of sulphur and ash, is worked to a very limited extent for local consumption only.

With Hu-nan there is a greater interest attaching, as this province, as already explained, presents virgin soil to the investigator. Hu-nan has an area of approximately 75,000 square miles, extending between the 25th and 30th parallels of latitude, and the 109th and 114th meridians

of longitude east of Greenwich. The population is placed, according to native official reports, at from 20,000,000 to 22,000,000.

The Yang-tse kiang marks the northern boundary, but nearly the whole of the surface of the province lies within the drainage areas of two rivers, the Siang and the Yuen. There are two other streams apparently independent, but which actually are tributaries of the first two, viz. the Li shwei and the Tse kiang. They both flow into the Tung-ting lake when it is a lake, but at other seasons the Li shwei joins with the Yuen and the Tse with the Siang. The Siang kiang, with its tributaries, have their headwaters on the northern flank of the Nan-ling mountains, which range, under several aliases, forms the divide

LEI-HO, NEAR LEI-YANG.

between the Yang-tse valley and the China sea. The valley of the Siang covers, therefore, the southern, central, and eastern portions of Hu-nan. The Yuen kiang rises in Kwei-chau, and drains western Hu-nan. In relative importance the Yuen is much inferior to the Siang, both in point of view of area drained, navigability, and as a trade route.

The Siang and the Yuen join in what is known as the Tung-ting lake, or, strictly speaking, what becomes the Tung-ting lake at certain seasons of the year. Owing to a recession of the hills that from Tibet seaward mark the south bank of the Yang-tse, the great plain formed by that river extends southerly into Hu-nan, a distance of 60 miles, so as to give the appearance of an alluvial delta deposited

by the Siang and Yuen rivers. This deposit, however, is of Yang-tse origin, as neither of the other streams flows through an alluvial soil. In winter, when all central and southern Chinese streams are at their low stage, the Siang and the Yuen cut through this alluvial plain in sharply defined beds, with banks 15 to 20 feet above the water-level. These streams are about half a mile wide, and 5 to 6 feet deep. When the rivers reach their summer flood, the whole plain is overflowed and a lake appears, through which the river-beds are but channels. This lake extends 60 miles south from the Yang-tse, and parallel to it for 75 miles. On the plain or lake-bed an attempt is occasionally made to raise an early spring crop, but such use is very limited. Along the channel banks are each year constructed settlements in mat shed houses, where junk men can obtain supplies, and near which, for mutual protection from thieves, junks tie up during the night; for, owing to the entire lack of beacons, buoys, or other aids to navigation, and on account of the frequency and variable character of shoals, all river travel is confined to daylight hours.

With the exception of this lake-plain the other parts of the province are mountainous, valley bottoms being, as a rule, small and narrow. On the east, the boundary between Hu-nan and the adjoining province of Kiang-si is marked by a range of hills rising steadily from the Siang, whose tops have an altitude of 2500 feet above that stream; on the south, the Nanling range, with peaks 5000 to 6000 feet above sea-level, separates Hu-nan from Kwang-tung; while on the west a less important upheaval divides Hu-nan from Kwei-chau.

The province is therefore a rectangular basin draining to the north. Rising in the south-west corner of the basin, and receiving the drainage from the north slope of the Nanling range, is the Siang kiang. At first its course is north-easterly to about long. 112° 30′ E., whence it turns and flows due north to the Yang-tse. In character the Siang differs entirely from its outfall the Yang-tse, although like the Yang-tse it is subject to violent rise during the spring and summer. Here the similarity ends. By far the greater part of the watershed of the Siang is mountainous and rocky, and of alluvial soil or soil easily subject to erosion there is little or none. The waters of the Siang are therefore comparatively clear. At lat. 26° 57′ N., long. 112° 35′ E., the Siang receives the waters of the Lei-ho, a stream flowing due north from the Nanling mountains, and whose size is as great as that of the Siang where the two join, but whose importance, from a commercial standpoint, is decidedly greater. The upper waters of the Siang and the Lei are contained in sharply defined and somewhat narrow valleys, where the hills run, as a rule, direct to the streams, leaving but little level area along the banks, thus holding the streams to fixed courses, and preventing change in bed, so frequently encountered with other Chinese streams.

The general course of the Lei is fairly direct and almost due north. Its upper waters consist of two streams, both of which rise in the Nanling mountains, and of which the easterly one bears the name of Lei, and the westerly that of Yu-tan. The latter is the more important, and it was traced to its source. The Yu-tan has its rise in the main pass in the Nanling called the Cheling, at an altitude of about 1000 feet above the sea-level. In a distance of 18 miles it has a fall of nearly 500 feet to Cheng-chau Fu, a prefecture town, and the most important in southern Hu-nan. Above Cheng-chau the stream is not navigable, the fall being too great, and the depth of water during the greater part of the year being insufficient. Northward, however,

FEI KIANG.

Cheng-chau marks the head of navigation, and the point of transfer between boat and portage over the Cheling highway. In mid-winter, when the rain is usually at the minimum, the depth of water on shoals between Cheng-chau and Yung-hsing, 58 miles, will not exceed 6 to 12 inches, so that for two months in dry years heavily laden south or up bound junks are compelled to discharge in whole or part at the latter point. The fall of the stream between Cheng-chau and Yung-hsing is 130 feet. During the spring, summer, and autumn the river rises so as to have an average depth of from 3 to 4 feet, and with this increase in depth the current becomes very swift.

Below Yung-hsing there is a regular communication at all times of the year for junks whose draft does not exceed 12 inches, and the Lei

assumes the character of a river. Its width at Yung-hsing is about 130 yards, which is gradually increased as the junction with the Siang is approached. From Yung-hsing northward the rate of fall decreases. Between Yung-hsing and Lei-yang, the only other point of importance on the stream, a distance by river of 34·5 miles, the total descent is 60 feet, and between Lei-yang and the Siang kiang, 50 miles, it is 80 feet. From Lei-yang northward the available depth of water at an ordinary minimum is 15 inches.

With the exception of the Yu-tan, there are no streams flowing into the Lei that are navigable at all times. The Fei kiang and the Cheng kiang are the chief tributaries. The former reaches an excellent deposit of anthracite, one of the few hard anthracites that we found, and the latter the bituminous field of Shing-ning. In the spring, summer, and autumn there is enough water to permit light junks to be drawn up against the current to bring down loads of coal. In the winter-time the shipment of anthracite from the upper Fei is suspended, the country being too rough to permit the coal being carried out on coolies' backs. Shing-ning, however, having fairly good paths, is able to continue shipping regardless of the stage of water.

On reaching the Siang the Lei joins a river about its own size, so that northward from this point there is a stream of more generous proportions, with a course almost due north, and where the limits of the drainage area recede on the east and west to the provinces of Kiang-si and Kwei-chau.

The banks of the Siang are less steep than those of the Lei; the hills in intermediate contact with it are less pronounced, and consequently there is found a greater extent of river "bottom" or arable lands.

The width of the Siang immediately below the junction is about 370 yards. At Lu-kau, the mouth of the Lu, its chief influent from the east, 85 miles from the mouth of the Lei, the width has increased to 470 yards, and at the Tung-ting lake to 850 yards. All of the above widths represent approximate width between banks at low-water stage.

The fall of the Siang between Lei-kau and Lu-kau is about 0·7 foot per mile, and below Lu-kau slightly less. The depth of the river on shoals available for navigation is variable, owing to the shoals themselves shifting at every flood. In general it can be said that junks drawing 5 feet of water can reach Yo-chau at all seasons. Between Yo-chau and Siang-yin 4 feet of draft can be counted on, except at one point in the Tung-ting channel, where the alluvial deposit is apt to collect during the winter, and so reduce the depth of water to 2 feet. I navigated it, however, in a junk drawing 3 feet without trouble. A very small amount of annual maintenance would give a minimum depth of 4 feet. Between Siang-yin and Siang-tan boats drawing 3 feet can proceed during the low-water stage in January, but with difficulty.

Above Siang-tan the presence of a large shoal in the great bend of the river reduces the navigable depth to not exceeding 2 feet. This shoal places Siang-tan at the head of large-junk navigation. Between there and Heng-chau the minimum depth falls to 18 inches, and above that point only very small junks or san-pan can proceed at all. These figures represent extreme low water in mid-winter. With the spring rains the river rises so that the flood depth at Lei-kau is probably 10 feet, increasing to 30 feet at Yo-chau. As a general thing the banks of the river are sufficiently high to be above flooding. Occasionally, and usually at points of influx of other streams, areas were found so low as to be subject to inundation. As such land is generally fertile and worth cultivating, the natives project the same by levees. As these low lands are not continuous, the protecting levees are local, and do not form, as is frequently the case along the Yang-tse, an extended system.

The course of the Siang is fairly straight and free from the great bends that we find in the Yang-tse, and which lengthen navigation on that stream. Between Heng-chau and the Yang-tse there is but one large *détour*—that of the Siang-tan bend caused by the hills at Chu-chau deflecting the river to the west. In the Tung-ting lake the channel through the alluvial deposit is very tortuous, owing to the shifting character of the soil.

The eastern part of the province of Hu-nan rises steadily from the Siang to the border of the province. Draining this watershed there are four principal streams flowing into the Siang above the mouth of the Lei, of which the largest are the Lu and the Mi or Chao-ting.

The important towns in Hu-nan, as in other provinces, are located on the waterways. The first one to be reached on leaving the Yang-tse is Yo-chau, situated 5 miles from the former and at the outlet of the Tung-ting lake. In 1899 Yo-chau was declared a treaty port, and a custom staff was assigned to the post. No business has been done, as the "Boxer" outbreak followed shortly afterwards. Yo-chau contains a population of possibly 40,000, is walled, and has a long gently sloping foreshore, on which junks can be conveniently beached at any stage of the river. Situated as it is at the north end of the Tung-ting lake, it is the gateway to the province, for all the in and out traffic of all rivers in Hu-nan must pass by it. The commercial importance of Yo-chau is therefore assured. The topography of the surrounding country is such that a foreign settlement can be easily built along the river-bank, either above or below the Chinese city.

Siang-yin (lat. 28° 40′ 30″ N., long. 112° 56′ E.), a walled city of perhaps 20,000 people, stands at the south end of the Tung-ting lake, 60 miles from Yo-chau. At times of high water the place becomes an island, as the river floods the country in the rear. In order to prevent its being entirely cut off, a masonry causeway has been constructed, connecting the city, which is above flood-level, with the hills behind it.

Chang-sha (lat. 28° 12′ N., long. 112° 59′ E.), the capital of the province, is like Siang-yin on the east bank, 45 miles south by the river from the latter. In many ways Chang-sha is one of the most interesting places in China. Of all Chinese cities it is the most anti-foreign. No missionary and but one or two foreigners have ever succeeded in getting within its walls, and even those foreigners who did get in, did so either surreptitiously or at night. After lengthy negotiations, the writer of this paper succeeded in persuading the governor to receive his whole party at a formal audience with all Chinese etiquette in the governor's yamen, the first foreigners to be so treated. The city is completely walled, although houses built between the wall and the river-front cut off any view of the wall from the river-side. The circuit of the wall is 6 miles, being substantially rectangular in plan, with a length of 2 miles, and a width of 1 mile. The Chinese claim 1,000,000 or more as the number of the inhabitants, but such claim, as with most other figures of Chinese population, I believe to be a gross exaggeration. Probably 500,000 is a better figure.

The streets are of the usual Chinese type—narrow, but well paved, and the houses for the most part are well built. The shops seemed to be generously supplied with all kinds of goods, both native and foreign. Many of the latter that I saw were not only of the regular line of staple goods, such as cottons, kerosene oil, lamps, umbrellas, timepieces, etc., but articles that one would scarcely expect to find in a city where no foreigners resided, such as American tinned vegetables and fruits, and English and German beer. As a further indication of the demand for foreign articles can be noted the establishment of a branch of a well-known firm of English chemists of Hong kong and Shanghai. This branch is in charge of a Chinese attendant, who, while he cannot compound foreign medicines, nevertheless sells all the ordinary preparations. We were able to replenish part of our stock of medicines and foreign goods in this most anti-foreign city. In addition to its importance as the provincial capital, and therefore the official residence of the governor and other high provincial officers, Chang-sha is a flourishing manufacturing centre in wooden articles, principally furniture and coffins, in silver and pewter ware and paper. When the present Emperor was first in power, he appointed as governor of Hu-nan a liberal and advanced official named Chen Pao-cheng, who endeavoured to overcome the antipathy of the Hu-nanese to foreigners. He founded what are called "foreign" schools, namely, those where science and modern subjects are taught, inviting Chinese teachers to come from Shanghai for this purpose, and even went so far as to instal an electric-light plant and a telegraph-line. With the advent of the Empress Dowager to power, Chen Pao-cheng was dismissed, and Yu Lien-san, a conservative, was put in power, who immediately set about to undo what his predecessor had begun in the way of reform. As a singular

SANDSTONE FORMATION OVERLYING SHING-NING COAL-MEASURES.

indication of the value of modern science as an agent of reformation, the electric light, having demonstrated its practicability and its advantages, was not only allowed to remain, but was actually extended. Chang-sha therefore presented the curious anomaly of being the most hostile city to all foreign ideas, and yet using one of the few foreign inventions which does not claim previous Chinese origin.

Siang-tan (lat. 27° 54′ 30″ N., long. 112° 51′ 30″ E.) lies by the river 30 miles south from Chang-sha, and situated at the great bend in the river. The original city of Siang-tan is quite small, as indicated by the wall, containing the several official yamen, some large temples, and a few buildings. The great shoaling of the Siang just above Siang-tan, forced upon the city a peculiar prominence as soon as the Hu-nanese began to trade with other ports of the empire. Junks capable of navigating the Yang-tse can ascend the Siang as far as Siang-tan, where the cargoes are transhipped to smaller boats capable of ascending the several rivers above that point. In like manner, coal and other Hu-nanese products arrive at Siang-tan in small lots, and are there combined into larger cargoes for outward shipment. This necessity for transhipment naturally developed commerce by wholesale on the part of native Chinese, who purchase cargoes of imported goods, and hold them at Siang-tan until re-sold in smaller consignments for interior points. Siang-tan has thus become a great distributing metropolis. The new or commercial city has extended itself northward from the old walled city along the river-bank for a distance of $3\frac{1}{2}$ miles, so as to give the maximum of access to the trading junks, which form a solid mass as they lie side by side against the shore. Parallel with the river are two business streets, and, back from them, minor streets and residences. The width of the city does not exceed half a mile. On account of its elongated shape, giving an exaggerated impression of size, and of the large amount of business which is transacted, only a small portion of which is local, Siang-tan has earned the reputation of being very populous, estimates of the number of inhabitants ranging from 1,000,000 to 3,000,000. Having had an opportunity to inspect the city, and having ascertained its thin width, I am forced to doubt whether the population exceeds 600,000. But as to its commercial activity and importance there is no question. Its shops are as well, if not better, provided than those of Chang-sha, and unquestionably a larger business is transacted, but the business, as explained above, is almost wholly one of commission, and there is none of the producing or manufacturing activity that is so manifest at the provincial capital.

Above Siang-tan the cities of note are: Heng-chau (lat. 26° 56′ 30″ N., long. 112° 35′ E.), with a population of 20,000, at the limit of navigation for boats drawing over 12 inches; Lei-yang, on the Lei-ho, the centre of the coal district of southern Hu-nan, with perhaps 4000 to 5000 population; Cheng-chau, already described as point of transfer

from boats to the Cheling highway, containing 5000 population; Li-ling, on the Lu-ho, the chief distributing point of central eastern Hu-nan, a city of considerable commercial activity, with a population of 20,000; and in south-eastern Hu-nan, the cities of Yu and An-jen, with 4000 and 2500 each. The only other city of importance in Hu-nan is Chang-te, at the head of junk navigation on the Yuen kiang. It bears to north-western Hu-nan the same relation that Siang-tan does to central, but it is neither as large nor as important, since the north-western section of the province is less prosperous than the central. Its population is estimated by the natives at various figures from 100,000 and upwards.

SHING-NING COAL DISTRICT.

From an economic geological point of view, Hu-nan invites attention chiefly through its coal-measures. As no systematic investigation of the province has ever been made, it is still impossible to give complete details.

The only notes hitherto obtainable on the geology of the province are those of Richthofen. His observations, however, were made wholly from boats. The rocks of the northern part of the province are of soft sandstone. At some point near Siang-tan the coal-measures begin, extending easterly to the boundary between Hu-nan and Kiang-si, and westerly to an unknown extent. The whole of the province east of the Siang kiang and south of Siang-tan is underlaid with coal.

The greater part of Hu-nan coal is anthracite, and as the natives prefer to burn what they call a non-smoky coal in their chimneyless

houses, no great effort was made until very recently to explore the bituminous deposits. Richthofen, in fact, has stated that the southern field was wholly anthracite, and that although the Siang river field was bituminous in character, it was of very inferior quality. In these statements he erred, due, in the first instance, to his not being allowed to land to explore the field in detail; and, in the second instance, to the fact that bituminous coals were not specially sought after, and therefore not developed.

Taking up first the coal-fields in the north, the most important deposit so far discovered is that in the neighbourhood of Ping-hsiang. This city, with a population of 30,000, is situated, not in Hu-nan, but in Kiang-si. Since, however, it lies within the Siang basin, and consequently has an outlet *viâ* the Siang kiang, it can be considered as Hu-nan coal. This Ping-hsiang coal is coking bituminous of a very high grade, showing on analysis fixed carbon varying from 55 to 67 per cent.; volatile carbon, 30 to 25 per cent.; ash, about 8 to 10 per cent., with moisture and sulphur both low, the latter, in fact, being much less than 1 per cent. As the coke is strong and compact, this is evidently a fuel that can be used for steam and metallurgical purposes. There are at Ping-hsiang five known seams, two of which have a thickness of 5 to 6 feet each, while the others are thinner, varying from 2 to 3 feet. They dip to the south-west.

Samples of coal said to be mined near Siang-tan were obtained, which on analysis proved to be bituminous, with 53 per cent. fixed carbon and 30 per cent. volatile matter. This would seem to indicate that the bituminous deposit extended from Ping-hsiang to the Siang kiang. South of this the coals generally change their character, the proportion of fixed carbon increasing, and of volatile matter decreasing, so that from the bituminous the variety passes through semi-anthracite to anthracite. The exposed rocks also change their appearance from sandstone to limestone and shales.

In eastern Hu-nan, along the road leading south from Li-ling through Yu and An-jen, coal is mined for local consumption. Apparently the whole of this part of the province is coal-bearing, but no extensive development work has been done. Such coal as is mined is anthracite.

The great coalfield of Hu-nan, and which has made the province famous, is the Lei-ho field, which extends southerly from the junction of the Lei and Siang rivers, and covers the Lei valley. This coal, being easily mined and having water transportation facilities at hand, has been worked for a great many years, and has found its way to all points, not only in the Siang valley, but along the Yang-tse as far as Shanghai. As it has been chiefly anthracite, the term Hu-nan coal has become synonymous with that variety, and it is likely that coals that have come from other parts have been and are sold under the trade name of "Hu-nan coal."

From Yung-hsing northward the native rocks are mostly shales, all much disturbed, with a dip usually varying from 20° to 40°, although in some instances it was found vertical. The seams outcrop above drainage, and have a thickness varying from 5 to 10 feet, although one seam was reported to have a thickness of 20 feet. These seams are attacked at the outcrop, and worked downward by means of a drift about 4 to 5 feet square, the coal being dragged up the incline in baskets by coolies. No side drifts are made, but the main one is carried down until either water is reached, which, on account of the lack of pumps, presents an insuperable obstacle to further progress, or until the depth is too great for men to be able to carry up the coal, when

PARSONS GAP. DIVIDE BETWEEN YANG-TZE VALLEY AND CHINA SEA.

operations are stopped, and the so-called mine is abandoned. In composition these coals contain from 70 to 80 per cent. fixed carbon, with ash from 9 per cent. upwards. On account of the very disturbed condition of the rocks, all the seams have been subjected to a grinding action, so that, unfortunately, most of the coals are of a very friable nature, crumbling easily into dust. In the estimation of the Chinese this is not a serious fault, as they break up all coal into fine particles and mix them with clay into balls about 3 inches in diameter before the coal is retailed. It is, therefore, quite possible that a thorough systematic examination will show deposits of hard coal which have been neglected in favour of the softer kinds. One such coal attracted my attention—a very hard anthracite found 10 to 12 miles up the Fei

kiang from the Lei-ho. This coal lay at the apex of an anticlinal axis, nearly horizontal, and therefore but little disturbed. Analysis showed it to contain 86 per cent. fixed carbon, about 3 per cent. of volatile matter and moisture, less than 6 per cent. ash, and only 0·2 per cent. sulphur. Its chemical and physical qualities would permit its use direct in a blast furnace according to American practice. Although every little town on the river-bank north of Yung-hsing is a coal-shipping point, the centre of the industry is at Lei-yang, a name sometimes applied to the whole district.

South of Yung-hsing a marked geographical change occurs. The shales, as the surface rock, disappear, their place being taken by a hard red sandstone in thick strata. When first found on going south from Yung-hsing, these strata dip to the south-east at an angle of 30°. In a distance of about 5 miles, during which the angle of dip is gradually decreasing, a synclinal axis is reached, when the dip changes to the north-west with a constantly increasing inclination. After crossing this formation for a distance of about 10 miles in a straight line, a range of hills averaging 2000 feet in height is met, whose direction is north-east—south-west. In this range, and beneath the sandstone, is a deposit of bituminous coal.

Mining operations in this field have been carried on for more than a hundred years, so that the existence of the deposit has been thoroughly established. Apparently it is a small basin in the midst of the large anthracite deposit, for coal of the latter variety is found on all sides. The basin, which goes by the general name of Shing-ning, but whose chief village is San-to, has a known length of at least 13 miles, and a width unexplored, as no deep borings have been made. There are said to be seven veins, whose thickness varies from 2 to 10 feet, with a "strike" north-east—south-west, and a dip to the north-west at an average angle of apparently about 20°. The coal burns freely with a long flame, and produces a strong coke. On analysis the fixed carbon was found to vary from 58 to 74 per cent.; the volatile matter from 14 to 19 per cent.; and the ash from 9 to 25 per cent. More careful mining and the washing of the coal would materially reduce the last. As all the mines are worked from the outcrop, it is possible that deeper operations would develop a more compact and cleaner fuel.

South of the Shing-ning district to the line between Hu-nan and Kwang-tung anthracite is again found, with fixed carbon averaging 78 per cent., volatile matter 10 per cent., ash 9 per cent., and moisture 3 per cent. All the deposits so far opened produce a coal that crumbles into dust, and which can be burned only by mixing with clay according to Chinese practice, or be compressed into briquettes.

The Hu-nan coalfield is very extensive, and contains an enormous tonnage of coals of different varieties. It needs careful, thorough, and

systematic exploration with a diamond drill, for it is probable that the most valuable deposits will be found below the surface, where they may be more compact.

The topography of Hu-nan presents a much-broken surface. With narrow valleys and limited areas of lands capable of being irrigated, Hu-nan does not rank as a province of agricultural wealth, except in the north-eastern portion. The most valuable crop is tea, grown chiefly to the east and north-east of Siang-yin, and which, when gathered, finds its way from the Hu-nan farms to the market-towns on the Yang-tse, or to Hsin-tien on the border-line between Hu-nan and Hu-peh, where it

RANGE AT NORTH END PARSONS GAP.

is bought by Chinese buyers and shipped by junk to Hankau. Inferior grades of tea are grown elsewhere in the province, but chiefly for local consumption, except in the neighbourhood of Cheng-chau in Southern Hu-nan, whence it is sent to Canton. Other crops are rice, raised everywhere in the province wherever suitable irrigation can be obtained; cotton, tobacco, vegetables for local consumption, and, in the south, oranges in great quantity and of excellent quality. The most fertile portions of the Siang valley are in the vicinity of Siang-tan and along the Lu-ho. It is in the latter district that rice is raised in sufficient quantity to supply local need and be shipped. More than 600,000 piculs, or say 40,000 tons, are shipped annually to points outside of Hu-nan.

In previous years the rough hillsides of southern and western

Hu-nan furnished great quantities of timber, and although the large trees have long since been cut, extensive rafts of small second-growth timber are frequent sights on the Tung-ting lake or on the Siang. It was interesting to note that the natives are beginning to recognize the value of growing timber, and that tree-farms on an extensive scale were seen in several places, but chiefly in the vicinity of Siang-yin. The pine, probably on account of its rapid growth, was in each case selected as the tree to be raised. Some of the trees had almost reached a point where they would pay to cut. That arboriculture had proved itself to be a successful venture was indicated by the quite general setting out of young plants. So much of Hu-nan is unsuited for farming, but is adapted for forestry, that it is safe to predict that the thrifty Chinese will, when they are convinced of the financial return, devote a very large proportion of the surface of the province to tree-farms. Another—in fact, one might say the only other—use to which the hillsides are put, except, of course, in those districts capable of raising tea, is for the growing of the tea-oil plant (*Camellia sasanqua*), a shrub with a height of about 10 feet, and a small trunk, from which the natives compress an oil suitable for all kinds of domestic uses, and forming an article of internal commerce.

In the way of manufactures, the article made in the largest quantity seems to be pottery, usually in the shape of large water-jars or roof-tiles, the latter sometimes coloured. Local officials stated that these jars were shipped to all parts of the Yang-tse valley wherever boats could reach. Junks laden with them outward bound were seen in great numbers. Next to pottery; furniture, paper, and bricks seem to rank in importance as articles of manufacture.

The architecture of the houses and the details of all kinds of construction exhibit the same characteristics that are common to similar structures in other parts of the empire. The cities are walled, with double-gate towers of proportions formidable against anything but modern artillery. The streets and houses in the cities resemble those of other parts of Central China, while the farm-houses vary in their design according to the fertility and prosperity of the district. In the farming sections of the Siang and Lu valleys, artistically designed and substantially constructed buildings set within a compound bespeak good crops and a farmer of means. Along eastern Hu-nan, where the soil is poor and arable land scarce, the houses are built of half-burned bricks, with thatched roofs, the whole meagre and unkempt, indicating a hard struggle to maintain existence.

The bridges, as elsewhere in China, excite the admiration of the traveller, especially of one of scientific training. The smaller structures are composed of stone stringers, while the longer ones are arches, some of the latter being structures reflecting great credit upon the designers. At Li-ling there exists an extraordinary wooden cantilever, consisting of

WU-SHWEI GORGE ABOVE LO-CHANG.

six spans, with a total length of 480 feet and a width of 20 feet. This exceedingly interesting bridge, whose history I could not learn, has masonry piers with a superstructure of large timbers in layers, at right angles to each other, forming projecting arms over the piers until the span is narrowed to a width to be bridged by a timber stringer.

Irrigation works are found everywhere, provided the land is capable of raising rice. The commonest form is a pond or reservoir with an earth embankment, constructed at an elevation sufficient to allow the impounded waters to drain naturally over the fields. Diversion weirs of stone or concrete were found on the small streams, while on those rivers whose fall was insufficient to permit their waters to be diverted, undershot water-wheels with buckets to raise water are employed. This last device is mechanically very uneconomical, but as each wheel suffices to raise enough water to irrigate a rice-field, that is all the individual owner asks for.

It had been anticipated that the Cheling highway and pass of the same name marked the low level in the Nanling range, for even such accurate observers as Richthofen and Morrison had not questioned the prevalent belief. In their journeys, however, they were hurried through by the Chinese officials, and, moreover, were not engaged in making specific determinations. In the present inquiry such a matter was of the utmost importance to be determined accurately and beyond question. A very small amount of investigation sufficed to indicate that ground lower than the Cheling pass existed in the same neighbourhood, but the discovery of such ground was a matter of considerable difficulty, owing to a peculiar geological formation. By tracing on foot individual streams to their springs, the true pass was discovered to lie some 5 miles north-east of the Cheling, and that the so-called Cheling pass was only a false pass on the flank of a valley, and, instead of marking the divide of the Yang-tse and the China sea, it actually lay in the drainage area of the latter.

The Nanling range runs east and west. Just east of the Cheling highway there runs a sharply marked spur, both north and south, whose ridge was estimated to be at an elevation of 2000 feet above the surrounding country, with the peaks 1000 feet above the ridge. The northerly extension of this ridge separates the valley of the upper Lei from that of the Yu-tan, and its uninterrupted continuance we traced to the junction of the two streams. This ridge precludes the possibility of any other low pass through the Nanling, except the remote chance of one existing at the headwaters of the Lei. As the Chinese report no pass until the Meling in Kiang-si is reached, it is fair to presume that this statement is correct, and that there is no break in the main range between Cheling and Meling. South of the main range the above-mentioned ridge continues to Shao-chau, forming the divide between the waters of the upper Pei-ho and the Wu-shwei.

This ridge stands, therefore, like a great wall, along whose western foot flow the Yu-tan and Wu-shwei rivers, the waters of which are found even in dry seasons within half a mile of each other. On the west side of these streams the hills again rise, forming the flank of another but much smaller spur of the Nanling, on which flank the Cheling highway has been located going through a gap or false pass, and to which the name of Cheling pass has been given. The reason for this mistake on the part of the Chinese is due to the peculiar formation of the valley proper. The local rock is a soft and soluble limestone. Crossing the valley are five dykes of harder limestone that have resisted erosion. These cross-dykes occur in two pairs in a distance of 4¾ miles, with a single one about midway. The height of the northern pair is 90 feet, with an interval of 1500 feet. The wall of the north one of the northern pair is quite steep, coming to a sharp edge on top. The south one has a steep wall on the north side, but a more gradual ascent on the south. The tiny basin between them is cultivated at the bottom, and is only 10 feet higher than the ground immediately to the north of the north dyke. The divide of the waters between the Yang-tse and the China sea takes place immediately to the south of the south dyke, the Yu-tan flowing north and through the limestone rock of the two dykes themselves. The survey party, to commemorate the discovery, named the pass "Parsons gap." The Wu-shwei flows south from this point, gradually increasing in size. By the time the intermediate dyke is reached it is a permanent stream, and pierces the dyke by means of a natural tunnel; and, again, likewise flows through the southern pair of dykes, which latter resemble the northern ones, except that they are larger. Their height is about 150 feet, with an equal width on top, and an intervening distance of about 2000 feet. The Wu-shwei at this point is a well-defined small river, even in dry seasons, is at all times clearly in evidence at the bottom of the valley, and issues from the sides of the dykes with a strong and vigorous flow like a huge spring. To one standing at either the north or south end of this valley, the cross-dyke gives every appearance of a terminal divide, and there is nothing, except a personal examination, that leads one to suspect that the highway is not what it appears to be. The native maps place the divide between the Yang-tse and China sea at the southernmost dyke, near the village of Yao-tien, and are, of course, in error. The elevation of the divide of the watershed is about 120 feet lower than Cheling, or about 1080 feet above tide. Baron Richthofen gave the elevation of Cheling at about 1000 feet, and Mr. Morrison put it down as not exceeding 1200 feet, both of which observations were based on barometric readings, but our instrumental determinations confirmed Mr. Morrison's limiting figure.

The provincial boundary between Hu-nan and Kwang-tung lies

15 miles south of Cheling, and therefore not coincident with the drainage lines. The change from Hu-nan to Kwang-tung is at once noticed in the architecture of the houses, as the latter follow the more solid Cantonese type of construction. The singular Kwang-tung pawn-shop, with its high and massive masonry tower, in which all goods are stored, supposedly safe from attack by fire or thieves, is also at once found.

Kwang-tung is freely open to foreign travel, and has been fully explored and accurately mapped, at least as far north from Canton as Shao-chau. The maps accompanying this paper give the details corrected for the Wu-shwei, which is the west branch of the Pei-ho after its dividing at Shao-chau. From the end of the Cheling highway at I-chang to Lo-chang, a distance by water of 44 miles, the river flows through a continuous gorge with a succession of rapids, the average fall of the stream being 8 feet per mile. Between Lo-chang and Shao-chau, 30 miles, the valley is much constricted, but the fall is less, being at the rate of 3·3 feet per mile.

North of Shao-chau the province of Kwang-tung possesses a very scant population. Along our route the only places beyond little hamlets of boatmen are Shao-chau, Lo-chang, Ping-shih, and I-chang. The first named is a city of some importance, containing probably 10,000 people. It is at the head of large junk navigation, *i.e.* available draught at low-water stage of 12 inches, and where all cargoes destined for the Cheling *viâ* the Wu-shwei, or the Meling *viâ* the Pei-ho are transhipped. Lo-chang owes its experience to the fact that it is the point where the rapids begin, and is therefore the limit of small junk navigation, for between Lo-chang and Shao-chau boats must draw less than 12 inches. At Lo-chang all cargoes are divided and loaded into small san-pan, drawing 3 or 4 inches at the maximum for transit between there and Ping-shih or I-chang, where they are unloaded finally for packing over the Cheling. Beyond being re-loading stations, these places have no other reason to exist. Lo-chang has a population of about 2500, and Ping-shih and I-chang about 1500 each.

The coalfield of Hu-nan extends southward to Shao-chau, but has never been seriously developed, owing to lack of demand, as Canton and vicinity can be more readily and cheaply supplied from West river points, Tonking, or even Japan. With proper transportation facilities, the coals of northern Kwang-tung will be developed. They are anthracite or semi-anthracite, samples obtained by me showing on analysis fixed carbon, 80 to 83 per cent.; volatile matter, 12 to 15 per cent.; and ash, 6 to 9 per cent. These coals were firmer than the average Hu-nan coal. South of Shao-chau the province of Kwang-tung is so well known that I can add but little that is new.

The population of Hu-nan, and for that matter the whole of China, has, I believe, been very much over-estimated. I travelled through the

most densely populated districts, and am convinced that the ordinarily stated figure of 20,000,000 for Hu-nan is too great by a half. Outside of Chang-sha and Siang-tan there are no great centres of population, while the country villages are very few and small as soon as one departs from the trade routes.

At the beginning of this paper mention was made of observations as to magnetic variation. At Hankau the variation was found to be about 40′ W., and this variation to diminish gradually to Cheling, where the line of "No variation" was crossed, from which point it increased to the east to Canton, where it was determined to be 45′ E.

The coalfields of Hu-nan have been described because they came under particular notice; but other minerals, such as iron, copper, antimony, lead, and silver, are believed to exist in paying quantities, but have never been developed. On account of its mineral wealth and location on the natural highway between Central and Southern China, Hu-nan is certain to be a great factor in the future commercial and industrial growth of China.

PROF. CVIJIĆ ON THE STRUCTURE OF THE BALKAN PENINSULA.

By Dr. KARL PEUCKER.

Prof. Cvijić, to whom we are indebted for definite proof of the glaciation of the mountains of the Balkan peninsula during an ice period,* and for the solution of the problem of the great Macedonian lakes, has applied the great store of observational data at his disposal to the unravelling of the life-history of the region. The investigation, which was no doubt prompted in part by the problems suggested by Eduard Suess in 'Das Antlitz der Erde,' is of exceptional interest and value as a geographical study.†

The chief points to be elucidated are, (1) the structure of the ancient core of the peninsula, consisting chiefly of crystalline rocks; (2) the relation of the core to the mountains resting upon it, which are composed of more recent sedimentary formations; (3) the relations of those mountain systems to one another—a chapter of surprises; and (4) the relation of the internal tectonic conditions to the surface forms of mountain and coast-line.

Prof. Cvijić's researches can be directly connected with those of the following investigators: in the west, A. Boué, Viquesnel, A. Bittner, E. Tietze, K. Hassert; in the south, M. Neumayr, F. Teller, A. Philippson, Hilber; in the north-east, Ferdinand von Hochstetter and Franz Toula.

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* J. Cvijić, 'Das Rilagebirge und seine ehemalige Vergletscherung, *Zeitschrift der Gesellschaft für Erdkunde*, Berlin, 1898, pp. 201–253. Also *Geographical Journal*, vol. xiii. pp. 427, 655.

† The first publication will be found in a series of short papers, maps, and sections appearing in the *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften*, Vienna, vol. cx. A complete account of all the observations and results will appear later in book form.

The ancient core of the Balkan peninsula is analogous to the *massifs* of the Scottish mountains in Great Britain, of the central plateau in France, and of Bohemia in Central Europe; it may be termed the "Rhodope" *massif*, from the name of its extensive mountain system (see map), and it includes, in the widest sense, the mountain regions of the central and southern part of the peninsula. It begins in the south of the Balkans, sends a branch north-westward through the middle of Servia to the border of the old Hungary-Croatian mass, which has almost disappeared, extends to the Ægean sea, and eastwards to the Black sea. The outline of the western boundary can be seen from the map; its trend is in general north and south. It is ill defined in parts, but in places longitudinal depressions like the lakes of Kastoria and Prespa, and, further north, the great Kosovo polje—the historic "Amselfeld"—make it perfectly clear. Depressions of this type are not, however, confined to the boundary between older and newer rocks; to the west, amongst the younger mountains, and again east of Lake Prespa, within the area of the ancient rocks, parallel lines of faulting and dislocation also run north and south. These include, in the west, the basins of Kortsha and Ohrid, separated from one another by a ridge of crystalline rock, and of Debar (of these the second is the largest and deepest; see *Geographical Journal*, 1900, No. 2, pp. 215-219); and in the east, the basins of Monastir (Bitolj) and Tetovo-Gostivar (Kalkandele). The discovery of *Schollen*, derived from fractures, has revealed the existence of similar depressions within the core, to the south of the Balkans; here also they run parallel to the fold of these mountains. While the strata of the younger mountains are in general only folded, fracture occurs near the boundary of the ancient rocks, along lines which correspond to the direction of folding. Within the Rhodope mass, the surface is not invariably formed of crystalline rock; beds of younger formation are common. The rocks of all ages are folded, but the newer (cretaceous) rocks lie unconformably on the older, notably around Skoplje (Üsküb). Only the most recent (neogene) deposits are unfolded, but these are often shattered into *Schollen* by fracture in such a way that neogene and crystalline rocks appear at the surface together; occasionally, at the margin of the basins, they stand vertically alongside. A region of this interesting type occurs in the north of Seres, Southern Macedonia.

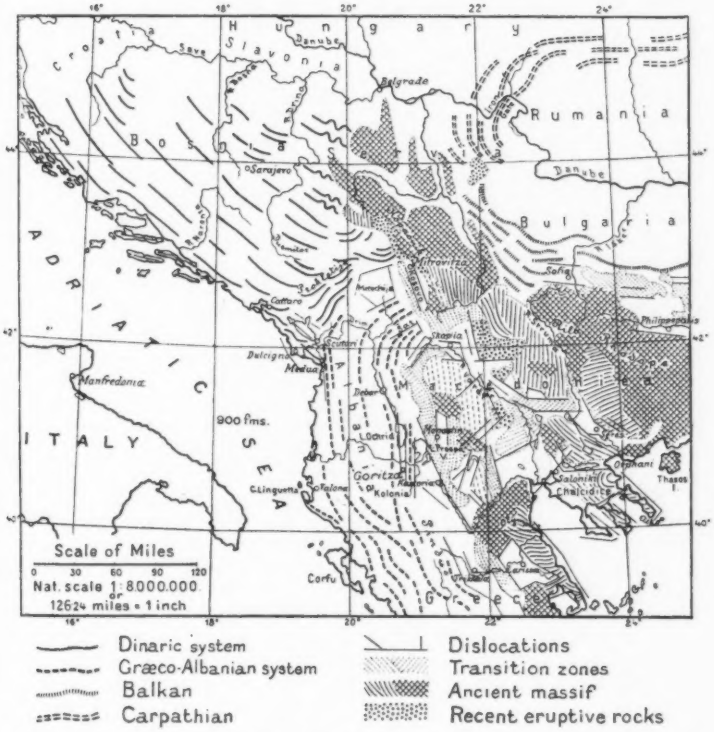
These two unconformities, between crystalline and cretaceous rocks on the one hand, and between palæogene and neogene on the other, suggest the occurrence of two distinct periods of severe folding, one after the formation of the crystalline schists, and one after the Cretaceous period; and it would seem that the second continued till middle Tertiary times, constituting the chief folding of the Rhodope *massif*. The *massif* is thus clearly distinguished from that of Bohemia, in which folding came to an end in the Carboniferous age.

After the folding, fracture and subsidence began, giving the mountain chains a direction independent of that of the lines of folding. From a long series of observations, Prof. Cvijić concludes that during the Quaternary period tectonic movements were practically absent in the north, while round the Ægean there was disturbance of exceptional intensity. The vertical displacement in the faults was often considerable: thus the Galičica rises 1300 meters (4300 feet) above the surface of Lake Ohrid, which is 286 meters (938 feet) deep, the Jakupica 2000 meters (6600 feet) above the bottom of the Skoplje basin, and the Schar-Gebirge about the same above the Kosovo Polje. But the greatest differences occur in the depressions in Southern Macedonia: the Gulf of Salonika is over 1000 meters (3000 feet) deep, and over it Olympus rises to 3000 meters (10,000 feet), and Mount Athos attains a similar height from still deeper sea. The intensity of vertical dislocation increases from north to south.

The dislocations, and with them the lake-basins, and also the beds of younger

rock, are entirely absent in the part of the Rhodope *massif* east of Vardar. This region is chiefly composed of granite, gneiss, and mica schist, with large quantities of recent eruptive rocks. It extends north-westward to the mountains of Southern Servia, such as the Kopaonik and others (see map). Its main axis forms the Rilagebirge, the highest (western) part of the Rhodope, the Pirin, and the mountains between Seres and Salonika; Cvijić terms this entire section of the ancient mass the "true core." The sections in Western Macedonia and south of the Balkans he characterizes as "transition zones;" they have certain features which distinguish them from both the Rhodope *massif* and the fold-

MAP SHOWING TECTONIC STRUCTURE OF THE CENTRAL AND WESTERN BALKAN PENINSULA.



mountains lying beyond them, and at the same time other features common to both. The resemblance is probably closer to the "true core," but there is also the correspondence of the lines of folding and fracture characteristic of the other area. It is noteworthy that the division into "true core" and "transition zone" denotes a difference more profound than that existing between the Rhodope and Bohemian *massif*.

Mention has already been made of the parallel dislocations in Western Macedonia. Their direction following that of the recent folds, is almost north and south

(S.S.E. to N.N.W.), the normal trend of the Græco-Albanian fold-system. The folding trends eastward in Central Greece only, but there are small deflections further north, in the folds which sink below the Adriatic at Cape Linguetta; these branch from the Pindus fold, which runs N.N.W., in the south-west of the Kolonia basin (see map). A "virgation" occurs here in the Albanian system, and the Acroceraunian group obtains a sort of secondary independence from the bend to a W.N.W. direction. But the normal trend does not correspond to that of the northern Dinaric fold, as has been assumed, nor do the systems coalesce; south-east of Scutari there is rather a bending of the Albanian beds to the north-east.

What relation do these bear to the folding of the Dinaric system? The normal Dinaric axis runs north-west to south-east, but there are frequent bends in the folding, even in the northern part (North-West Bosnia), to east and north-east, and this occurs more frequently the further south we go. The grouping of the normal and deflected folds is such that the successive bends may be said to form a series of overlaps; the conditions are markedly different from those met with in the Jura and the Appalachians, where the direction of folding is constant. The islands and peninsulas of the Dalmatian coast correspond to eastward folds, but the deflection increases towards the south-east. From Cettinje the folds, although not all in the same latitude, bend to the north-east; here again we have the succession of overlaps, especially in the coast mountains between Cattaro and Dulcigno. The same structure appears finally in the Rumija mountains between Dulcigno and Lake Scutari, where it forms a kind of tectonic centre. The eastward deflection is specially remarkable here, for low ranges, maintaining the normal direction of fold, extend as far as Medua. The bending to the east is, as it were, begun, but before it can be completed there is a sudden shift through a right angle to the north-and-south direction of the Albanian folds. At this important point there is a sharp boundary between the pure limestone of the Dinaric ranges and the "Flysch," rich in serpentine, of the Albanian. We shall return to the problem of those southern Dinaric ranges. The fold which bends north-east from the Rumija mountains continues beyond the southern end of the Scutari lake as the Rosaf mountain, on which is a Turkish fortress, but all the folds of the coast-ranges between Cattaro and Dulcigno are continued, with the break at the depression of the Scutari lake, in the ranges of the so-called North Albanian Alps, or Prokletije (see map). So far as is known, the strata forming the latter correspond to those of the Dinaric system, to which we may therefore conclude they actually belong. Although their topography is imperfectly known, it can be said that in length, height, and boldness of outline the Prokletije are the most remarkable members of the Dinaric system, and amongst the most noteworthy ranges of the peninsula. According to Kurt Hassert's estimates, which have been checked by Cvijić, several of the peaks of the Prokletije exceed Durmitor in Montenegro (2530 meters—8300 feet) in height. Durmitor has hitherto been accepted as the highest mountain of the Dinaric system, but it seems likely that some of the Prokletije rise to at least 3000 meters (10,000 feet). The Prokletije consist of several ranges, which together sweep round in a great bow, having the convex arc to the south-east. The general character of the ridges is similar to that of Durmitor, and of the mountains of Herzegovina on both sides of the Narenta. The outermost or south-eastern range is the highest; it rises steeply out of the great plain of the Metochija, and in no other part of the peninsula are greater differences of level to be found. The limestone walls extend right down to the level of the plain, and it occurs to one at once that here is a structure due to faulting, a supposition confirmed by the presence of thermal springs at Banja and Drsnik.

The Dinaric folds bend to north-east in the same way as the Albanian.

South-east of the Scutari lake the two run close together, the latter forming the southern foothills of the Prokletije, from which they are separated by the valley of the Kir, a stream flowing into the Drim near Scutari. Abundant limestone and dolomite are characteristic of the Dinaric system, while the "Flysch" zones are distinguished from those of the Albanian system by the complete absence of serpentine. South of the great Metochija subsidence the Albanian folds trend south-west to north-east in the Paštrik, Koritnik, and Schar ranges.

The folds of the Dinaric and Græco-Albanian systems form what Eduard Suess has termed a *Scharung*. The Dinaric folds bend more and more persistently to north-east as we go southward, ending in the ridge of the Prokletije, where the greatest elevation is attained, and meeting the Albanian folds before the latter have been fully deflected from north to north-east. In this *Scharung* lies a series of open basins, the origin of which is purely tectonic. Of these the tertiary basin of Metochija lies furthest to the north-east; in the centre, and much lower down, is the diluvial basin of Scutari; and the lowest depression in the bottom of the Adriatic must be counted as a third. According to the soundings made by the Italian and Austro-Hungarian Governments since 1867, the last-named lies in a line drawn from the Metochija basin to the inner angle of the coast, and runs steeply down to a depth of 1645 meters (5400 feet, or 900 fathoms). Cvijić names this deepest of the three basins, after the name of the bay, the Medua basin. The Albanian ranges attain their greatest heights in their north-easterly course south of the Metochija plain, and although, on account of certain peculiar tectonic features, Cvijić does not consider the proof that the Schar mountains belong to the Græco-Albanian system quite complete, it is nevertheless remarkable that their direction and general elevation suggest that they are the analogue of the Prokletije (Ljubotin summit stands at 2510 meters, or 8200 feet).

In any case, it may be said that the discovery of the *Scharung* structure between the Dinaric and Græco-Albanian folds solves the old geographical puzzle of the transverse position of the two great mountain systems on the frontier between Montenegro and Old Servia and Albania.

Returning now to the relations between the boundary of the younger folded systems and the two zones of the Rhodope *massif*, it is important to observe that the bend of the strata to east and north-east can be traced in a part of the transition zone of the ancient mass to the south of the Schar mountains and west of Skoplje (Üsküb), parallel with the longitudinal direction of the Tetovo-Gostivar depression, as already stated. But it is no less remarkable that in the north-east the Schar range, on attaining its greatest elevation, drops suddenly at a fault, and abuts on the crystalline rocks, the lines of folding running at right angles. This fault-line contact with the ancient *massif*, which has already been noticed in the southern part of West Macedonia (Kastoria-Prespa), continues northward beyond the Schar mountains as far as Novibazar, between Montenegro and Servia, north-east of the Prokletije. The subsidence along this line was accompanied by outbursts of eruptive material, which appears between the folded and older crystalline rocks. Still further north again, in Western Servia, the Dinaric folds abut against the crystalline mass at right angles, and it is interesting to note that the line of contact takes a zig-zag form. The "winding folds" disclosed here constitute a new tectonic form, which has not been observed elsewhere (see map). On the other side, north-east and north of the Rhodope *massif*, the folds of the younger mountains run, in general, parallel to the line of contact. Within the folds themselves, however, occur structures similar to those between the two recent systems in the west. They do not, as has been assumed, form a single system, but belong to two, the Carpathian and the Balkan. The outer fold-lines of the former, coming from the

north, bend east and south-east to the south of the Iron Gates, and disappear beneath the unfolded Sarmatic schists of the Bulgarian plateau. The folds of the Western Balkans, like the master-fold of the Central Balkans discovered by Toula, constitute a separate system.

This sketch of the general tectonic conditions was essential to a clear understanding of the relations between outer and inner structures of the Balkan peninsula, of which we may now indicate the main lines, as laid down by Cvijić. Tectonic agencies are supreme in determining the terrain within the Rhodope *massif*, *i.e.* in the central and south-eastern parts of the peninsula. The original folds have been broken through by the dislocations referred to above, either diagonally or at right angles to longitudinal axes, so that the geological and orographical lines rarely correspond. The fractures and subsidence of *Schollen* have completely altered the direction and grouping of the mountains which existed before the vertical dislocation occurred, and in their place we have wide undulations and plateaus of rounded uniform outline, 20 to 30 kilometers in width, quite distinct from the younger folded mountains with their narrow ridges. Still more characteristic are the depressions, which are a direct result of the dislocations; these have cut deep basins which afford a strong contrast to the form of surface just described. Some of these basins cover 1000 square kilometers (400 square miles), and the fundamental difference between the terrain of the *massif* and the region of younger rocks is their relatively large number. Many of them were deep lakes at the beginning of tertiary (neogene) times, and were subsequently dried up, partly because of the lowering of the outlets, partly on account of climatic changes. These dried-up neogene lakes are the European analogue of the great diluvial lakes of North America discovered by G. K. Gilbert. In America, as in Europe, nearly all lakes date from the end of the glacial period, and Cvijić's discovery of lakes of much greater age is of extreme interest. The survivors are the Ohrid lake, the two Prespa lakes (of which preliminary bathymetrical charts were reproduced in the *Journal*, 1900, No. 2, p. 216), and the Kastoria lake. In these lakes the formation of deposits is still going on, and the fauna still lives which the deposits in the dried-up basins show to have inhabited them for untold thousands of years. A transitional phase between the present lakes and the dried-up basins appears in several regions. In the place of the great neogene lake of Seres, for example, there remain three shallow pools. As we have seen, the southern basins are more recent; the lakes in the neighbourhood of Salonika are post-tertiary or diluvial; so is the Ostrovo lake, which lies between them and the Prespa lakes (see map). Along with three smaller lakes, these form the remains of one extensive lake of diluvial age. It appears, therefore, that the large number of lake-basins in the Rhodope region, and especially in Macedonia, are the result of tectonic displacements.

Amongst the mountains of the Dinaric system it is noticeable that the deflection in the direction of the *Scharung* seems to influence the formation of the large plateaux near Sarajevo and south-east of it by unusual disturbance of the neogene beds and other evidences of recent displacement. In the "Karst-poljen" the post-tertiary or diluvial terraces are always 15 to 20 meters lower in the south-west than in the south-east and north-west. The streams usually run south-west, and most of the gorges are on the south-western slopes. In these morphological features Cvijić recognizes the action of sinking of the Dinaric system by a series of steps to the Adriatic. In a paper on the Adriatic during the glacial period, under the title "L'époque glaciaire dans la peninsule des Balkans" (*Annales de Géographie*, ix. pp. 359–372, Paris, 1900), he has shown that only the northern, shallow part of the Adriatic basin can be of recent origin, the deeper southern part being older than the glacial period. Suess ('Antlitz der Erde,' vol. iii. p. 420)

has traced the actual coast-line of the older basin; it extends from the long Dalmatian peninsula of Sabbioncello across the present Adriatic to the small islands of Pelagosa and Tremiti and the east coast of Italy (see map). But the morphological conditions still further to the south-east appear to be the result of recent subsidences, and Cvijić regards the *Scharung* region inland from the Bay of Medua as the seat of greatest intensity of this subsidence. In consequence of it, all the valleys have become lakes, there are no signs of river erosion and no affluent streams; the slope surfaces have geometrical forms, bounded by straight lines along the ridges and between the foot of the slopes and the plains, as, for example, in the Mal Rencit and Kakaricit, north-west of Medua. Again, the subsidence has raised the level of the ground water, lessening the difference between it and the water parting; the drainage water has little erosive power, the slopes are not dissected, and neither valleys nor subterranean channels, like those of the Karst region, are formed. The fissures in the limestone afford the only escape for the surface water, and along these fissures the erosive action is intense; hence the modelling of the Sieb mountains. These ranges, which belong to the most southerly of the normal folds, called by Cvijić the "resistent Dinaric folds," are the type of intensely "verkarstete" mountains, the action being even more highly developed here than in the Karst plateaux above Fiume and Trieste, or in Lower Herzegovina. Every bed or surface of limestone is perforated and decomposed as if strong acid had been poured over it instead of rain-water. In some places the process of solution has gone so far that the more resistent masses stand out as monoliths, some as much as 8 meters (26 feet) high, giving the appearance of a plateau strewn with monuments and ruins.

But the existence and character of the Scutari lake is the strongest evidence of the subsiding movement, as has already been pointed out in the current volume of the *Journal* (No. 2, pp. 211, 212).* From the absence of fresh-water deposits, and other facts, Cvijič concludes that the Scutari lake came into existence in late glacial times. Both the deep clefts in the lake bottom at the south-western corner, and the small pointed inlets, are the result of subsidence. Valleys have been drowned out by the rising of the ground water. In the lower parts of the plain the ground water often covers detached areas of several square kilometers extent, and in winter all the low-lying ground is submerged. The slight fall of such rivers as the Bojana, the Drim, and the Kir causes them to overflow their banks, and large tracts of country are flooded. The whole region, in fact, frequently becomes a bay of the Adriatic and the "resistent" ridges veritable *Scoglien*. The amount of the material deposited by the *Scharung* rivers is then enormous, the Drim and the Kir affording some of the most striking examples of river transport in Europe, as has been described by Boué and Hahn. The Kir at one time flowed into the Scutari lake, now it joins the Drim at a point considerably to the south.

Tectonic agencies have also exercised a profound influence on the outline of the Balkan peninsula, more especially the Dinaric-Albanian *Scharung*. On account of the sharp bend in the folds in the interior, the coast-line shows an opening in the form of a bay, the bay of Medua. On the south-east, the gulfs of Salonika and Orphani correspond to this, except that they cut much closer into the peninsula. The researches of the Austrian geologists F. Teller and M. Neumayr have clearly shown the gulf of Salonika to be due to subsidence, and the three-pointed inlet of Chalcidice to faulting. Cvijić has now assigned the bay of Orphani to faulting, and

* A preliminary bathymetrical chart of the Scutari lake, from Cvijić's soundings, appears in *La Géographie*, 1902, pp. 259–260. The scale is 1 : 260,000, not, as stated. 1 : 150,000, which was the scale of the original before reduction.

this whole system of fractures, and with it the form of the coast of the northern Ægean, has been brought into relation with the southward-increasing subsidence within the Rhodope *massif*. The angle of the bay of Medua and the subsidence on each side of Chalcidice have their origin alike in the interior, and the broad openings extend from the *Scharung* basins described above and the "Amselfeld" or basin of Kosovo to the gulfs of Medua and Salonika, right through the heart of the peninsula. The increase southward of the vertical dislocations in the ancient core has led to the Balkan peninsula having its least breadth from north to south, and has opened a natural highway—the line from Belgrade to Salonika. The varied tectonic phenomena of the *Scharung* have given the west coast the nearest and most convenient harbours for the central districts.

Two different types of coast meet in the bay of Medua—the Albanian from the bay of Valona, and the Dinaric or Dalmatian type from the north. The rocky Dalmatian coasts consist of pure chalk and old Tertiary limestones, the Albanian of "Flysch" rock and weak neogene strata. The outlines of the former depend solely on the rock structure, according to the level to which subsidence has taken place; and since the limestone is dissolved chemically rather than weathered, there is little *débris*. The Dalmatian coast is accordingly of very simple type; being longitudinal, its features run in lines. Long stretches are practically straight, and the subsidence and submergence of valleys accounts not only for the systematic arrangement of the component parts, but for their extraordinary parallelism, as in the islands, peninsulas, and straits. The action of waves develops only minor forms, coves and creeks, caverns and natural bridges, or narrow channels 100 meters or less in length, like those in the island of Lacroma; minor forms which, nevertheless, give to these bare rocky shores a charm which is wanting on the Albanian coasts. The Albanian coasts follow the normal direction of the strata—north and south, and in contrast to the Dalmatian coasts, they often present wide flat stretches formed of river deposit. Between these cones of submerged deposit the coast retreats in open bays, and when islands are wanting, their place is taken by *Nehrungen*, dunes, and other tokens of a shallow water-coast. Inshore rises the steep coast of the ancient Adriatic of Tertiary time which has risen high above sea-level, like the coast of the Ægean, and in contrast to the Dalmatian coast. Cvijić points out that the effect of these variations in the changes in level, here elevation, there subsidence, has not been lost sight of as a factor in the formation of the *Scharung* basin of Medua itself.

The tectonic sketch-map of the central and western parts of the Balkan peninsula has been prepared by the author from the large scale-maps and from the private data of Prof. Cvijić.

ADMIRALTY SURVEYS DURING THE YEAR 1901.

Under the orders of the Lords Commissioners of the Admiralty, seven of His Majesty's vessels, with three small hired steam-vessels, manned by 64 officers and 622 men, have been employed on hydrographical surveys on the home and foreign stations.

The following is a brief summary of the work accomplished, as detailed in the report prepared for presentation to Parliament:—

Reports of 315 rocks and shoals, which were dangerous to navigation, have been received at the Hydrographic Department, and were notified to the public by notices to mariners; 1360 miles of coast have been charted, and an area of 7851 miles has been sounded.

In Great Britain, various resurveys of parts of Portsmouth and Plymouth harbours were made. Parts of the coast of Yorkshire were resounded. Areas in the Thames estuary were re-examined; and the river Stour was resurveyed.

St. Helier in Jersey was surveyed, and other amendments made to charts of the Channel islands. Detailed observations on the tidal streams among these islands were also carried on for several months.

The upper portion of the Bristol channel was resurveyed, and much change found.

Kyle Rhea, Kyle Akin, and Raasay sound were recharted, several new rocks in the passages being discovered.

In Newfoundland, the survey of some of the intricate bays in Notre Dame bay was accomplished, and part of the harbour of Sydney in Cape Breton island was surveyed.

In the Red sea, a survey of the strait of Bab-el-Mandeb and its approaches was finished.

In the China seas, two ships were at work. The waters round Labuan were surveyed. Two surveys were made in the vicinity of Hong Kong. Part of the shores of the British sphere of interest in Shantung promontory was recharted; and various searches made for reported dangers in the China sea. One of these resulted in the verification of a very dangerous small reef in the centre of the approach to the Yellow sea, lying 80 miles from the nearest land, and which had been touched by the P. and O. steamer *Socotra* in the night in 1900.

In Australasia, the survey of the inner route on the Queensland coast was continued, and various dangers found, others disproved.

Surveys of the Bay of Plenty, in New Zealand, Tauranga and Coromandel harbour, and other places were made.

In British Columbia, the survey of Johnstone and Broughton strait, and of the strait south of Active pass was completed.

The survey carried on by the Indian Government charted the coast between Cuddalore and Point Calimere, the Pamban pass, and Salaya harbour in Kutch.

During 1901, the Hydrographic Department has published 106 new charts and plans, and 28 new plans have been added to existing plates.

The number of charts printed to meet demands has, during the year, amounted to 538,973.

REVIEWS.

ASIA.

Russian Turkestan.*

The literature of Central Asia is growing by leaps and bounds, unfolding new scenes, unearthing new treasures, and ever deepening the curiosity of Western readers. The student of the subject has reason to congratulate himself heartily upon the latest addition, M. Krafft's magnificent photographic representation of Oriental life. The reviewer has a difficult task before him—the necessity of praising without reserve. As to the scope of the book, few words suffice; the rest must be seen. How can the critic speak when the artist eloquently preaches? The author has traversed Russian Turkestan from Marghelan to Bokhara, touching the important centres

* Hugues Krafft, 'A Travers le Turkestan Russe.' VII. and 228 pp., 265 photos and 1 map. Paris: Hachette. 1902.

of Kokan, Tashkend, and Samarkand. The text is a well-written, simple, and straightforward account of the country; it can be recommended as a most reliable introduction to the study of the region, and a perfectly safe guide to future visitors. The descriptions are correct, showing careful observation and sound judgment. In separate chapters we find comprehensive surveys of "Modern Russian Towns," "Ancient Native Cities," "The Great Monuments of Samarkand," "Country and Landscape," "Dwellings and Customs," "Types and Costume," "Great Mussulman Festivities." Here and there the author has added to and improved the information given by previous travellers. The appendix contains data on statistics, administration, history, trade, industry, archæology, etc., and the map is made more useful by references to historical geography, the names in question being printed in red.

Thus, on the text one cannot pass any criticism. What the author wished to say he has said well, leaving no room for adverse comment. He does not pretend to offer the results of original research, nor could we fairly ask for such, seeing that all his attention must needs have been focused on the working of his camera. The letterpress is a running commentary worthy of the pictorial and artistic part, and of this latter one can hardly speak with too much enthusiasm. I have wandered through the crowded streets of Bokhara city, and my eyes have dwelt often on the stately mosques of Samarkand. M. Krafft reproduces these scenes for me as none have done before. I recognize the old haunts and the familiar faces of the bazaar; there is the fruit-stand at the corner, the old curio-dealer, true to nature with every wrinkle of his features; and there is the boy who used to sell cakes in our neighbourhood. They all come back and speak. The fine tracery on the crumbling walls of Shah Sindeh tells its melancholy tale of beauty doomed to perish from neglect. When the artist touches the chord, memory responds.

Here we find the combination of technical skill and æsthetic perception to which Sella has accustomed us in other subjects. It is quite impossible to select for special mention a few out of the 265 photographs. The best cannot be found; it would be futile and invidious to search for the inferior. The greater number represent the people and their life; next in importance are architectural studies. Among the landscapes is a peep of the high mountains from the village of Urgut, which seems to have been the most outlying station touched by the author. The portraits are splendid, and afford first-class material for the study of the racial types of Uzbeks, Sarts, and Tajiks. Dwellings, dress, and occupations are depicted with exhaustive thoroughness, and we are instructed in every detail of the day's work or pleasure. Many are the rare views, so difficult to obtain, of religious ceremonies, of crowds and festivities, or of the demi-monde of Samarkand. The series on the game of the goat at Afrasiab is very fine indeed. Thus one might go on praising indefinitely, but I hope I have said enough to tempt the most sceptical reader of reviews.

The day may come when the brilliant hues on the khalat of the Bokhariot merchant shall yield to European uniformity of costume, or when the courtesan of the Baikabak will wear last year's spring fashions from Paris. Then the full importance, the immense value, of M. Krafft's beautiful book will be appreciated with tenfold intensity by those who came too late to have seen the days of old, and by those who can still recall them to memory. Their regret for the glories of the past will find consolation in a tender and sincere gratitude to him who saw these things and knew how to perpetuate them.

W. R. Rickmers.

AFRICA.

Early Travel in Angola.*

The importance of Mr. Ravenstein's volume to the student of historical geography is not to be measured by its size alone. The text of the narrative of sixteenth-century travel, therein reprinted from 'Purchas his Pilgrimes,' occupies in it no more than seventy pages, while with the introduction, appendices, and the excellent index and glossary, it does not extend to two hundred and fifty; yet it may safely be said that few of the hundred odd volumes so far issued by the Hakluyt Society possess a greater original value as contributions to the history of geographical discovery. The editor has done his part in a way which makes the book a model of what such a work should be; and, though many of the early narratives made accessible by the useful work of the Hakluyt Society surpass in intrinsic interest the simple story of the adventures of Andrew Battell, this is more than made up for by the careful and thorough elucidation, not only of the many obscurities of the text, but of the whole history of early European intercourse with Angola which Mr. Ravenstein supplies. In collecting material for the maps and notes, he was at the pains to consult all available literary sources of information on the history and geography of Kongo and Angola, from the old writers like Lopez and Cavazzi to the modern works of Baptist missionaries and others; and it was a happy idea to present the general results of his researches in appendices, describing the history of those countries from their discovery to the end of the seventeenth century, which form perhaps the most valuable part of the volume. The map by which the history is illustrated has been compiled with much care, amid difficulties arising from the surprising absence of detailed information on many districts even at the present day. In spite of these, Mr. Ravenstein has succeeded in tracing the probable routes, not only of Andrew Battell, but of the various Portuguese expeditions, Roman Catholic missionaries and others, including that laid down by Dapper in his map as leading to "Condi" on a southern branch of the Congo, which modern exploration enables us to identify satisfactorily with Nkundi on the Kwango. One result is to prove once more the baselessness of the idea that the Portuguese of those days possessed a knowledge of the remote interior, and to justify the absence of detail on the central region on such maps as that of D'Anville in 1732.

AMERICA.

The French in Canada.†

This work is the outcome of much painstaking research, and may be considered as a serious contribution to our knowledge of the first beginnings of Canadian settlement and trade. Originally presented as a thesis for the degree of Bachelor of Letters at Oxford, it has since been considerably extended so as to form a compact and at the same time complete summary of our knowledge of the inception and execution of the various undertakings of the sixteenth and early seventeenth centuries, by which the way was paved for the ultimate entry of Canada into the family of nations. The outlines of the story have often been told before, both in the works and biographies of the actors themselves, such as Champlain, and in the more general narratives of modern writers, like Parkman, Harrisse, and

* 'The Strange Adventures of Andrew Battell of Leigh in Angola and the Adjoining Regions.' Edited by E. G. Ravenstein. London: Hakluyt Society. 1901.

† 'The Early Trading Companies of New France.' By H. P. Biggar, B.A., B.LITT. (Oxon.). University of Toronto Library. 1901.

Winsor, and it was not to be expected that anything decidedly new would be brought forward by the author; but in matters of detail, especially as regards the negotiations and proceedings by which the formation and organization of the great trading companies was brought about in Europe, Mr. Biggar supplies some new and valuable material. Not content with a perusal of published authorities, old and new, voluminous as these are, he has himself searched among unpublished records both in this country and on the continent, and has besides enjoyed the co-operation of various French workers in the same field. The results of the study are given in a readable form, and their value is increased by the exhaustive references to the original authorities, which will enable serious students to extend the investigation on their own account, if so disposed. The second half of the book, consisting of a critical examination of the sources, is fully equal in importance to the narrative portion. Mr. Biggar makes no claim to have finally settled the many questions on which fuller knowledge has been a desideratum. He has thrown no new light, *e.g.*, on the disputed question of the faith in which Champlain was brought up, or on the obscurity which attaches to Sagard's early career. But his work marks a step in advance, and should be a decided help to any who may be disposed to dive further into the fascinating story of pioneer effort in the New World.

The Norsemen in America.*

This interesting and valuable study treats the subject under five main divisions, of which the first (pp. 1–10) is given to the oldest (eleventh and twelfth century) accounts of the Norse discoveries in America; the second (pp. 10–19) to the later (thirteenth and fourteenth century) traditions of the same; the third (pp. 19–40) to the Norse colony in Greenland; the fourth (pp. 40–57) to the closing records of Scandinavian settlement in the far North-west; and the fifth (pp. 57–112) to the Cartographical Representation of Greenland in the fifteenth and sixteenth centuries, especially by Claudius Clavus, Nicholas (Nikolaus') Germanus, and Martin Waldseemüller. Father Fischer's work is illustrated by ten maps, the first six of which are taken from various works of Nicholas Germanus, and two others from Waldseemüller. Herein geographical students may find an excellent summary of the whole subject of the Greenland, Vinland, and other American voyages and settlements of the Northmen, largely based upon Storm and Reeves, but taking account also of other investigations, and discussing the whole with considerable originality and suggestive power. The cartographical dissertation is especially valuable, and represents the greater part of the author's own contribution to scholarship in this volume, especially in relation to the strange perversion of many fifteenth and sixteenth century maps (*e.g.* one of Nicholas Germanus of c. A.D. 1483), which placed Greenland, as a European peninsula, immediately north of Scandinavia, and east of Iceland. Very interesting and reasonable is the picture Father Fischer attempts to draw (in Part III.) of the Norse settlements in Greenland, their population, occupations, food, and buildings, as well as of their attempts to extend their knowledge and civilization to the north, west, and east. Every scrap of evidence is carefully used, from kitchen-middens to Runic inscriptions; and the well-known settlement of 1135 on Kingiktorsoak island in Baffin's Bay, on one side, is balanced by the equally striking record of the discovery of Svalbaldr (Jan Mayen?) to the east of Greenland, in 1194. Among the other notable features of the present work is the full reprint and discussion of the letter of Pope Alexander VI., in 1492–93

* 'Die Entdeckungen der Normannen in Amerika.' Von Jos. Fischer, S.J., in Breisgau. 1902.

(lately discovered by Jelić), which gives us our latest-known information of the old Greenland colonies. But, as already noticed, the main feature of Father Fischer's study is his treatment of the map-portraiture of the north, and especially of Greenland in the cartography of Clavus, Nicholas Germanus, and Waldseemüller; in the course of this, Storm, Ruge, and Wieser (and especially the *Claudius Clavus* of the first-named) are vigorously supported in their criticisms of Nordenskjöld. There is, unhappily, no index, but an excellent list of "authorities" and "books consulted" is prefixed to the text (pp. ix.–xii.), and an appendix of documents relating to Nicholas Germanus is added (pp. 113–126).

C. R. B.

PHYSICAL GEOGRAPHY.

The Sea-Coast.*

The author deals first with the action of shore-waves and with littoral drift, in which he explains his notion of the wave of flood-tide, acting by means of small constituent undulations, which form breakers; and then passes on to a general description of the structure of sea-walls, as to which he speaks with authority, as an engineer of experience. Chapter V. gives instructive details with numerous figures of the sea-walls at Hove, Scarborough, Westgate, Bognor, Clacton, Southend, Bridlington, Blackpool, Dymchurch, Herne Bay, Felixstowe, Morecambe Bay, and of some of the sea-defences in Belgium and Holland, including the great Helder dyke. Chapter VI. deals with groynes, as to the form and structure of which there exists even more difference of opinion than on the subject of sea-walls. Under this heading a description is given of the ingenious system of groyning adopted by the late Mr. Case. The popularity of the Case groynes has undergone no diminution since the lamented death of their ingenious inventor. There is, however, some danger lest his principles should become a mere rule of thumb in the hands of less original men, and thus lead to applications which their inventor would probably not have sanctioned. Mr. Wheeler does not himself, in the work before us, advocate any special system of groyning or coast-protection, but strives to afford such information as to the varying geological and tidal conditions attaching to sea-coasts, and the result of protective works carried out under different degrees of exposure, as may be of service to those having charge of protective works, or interested in the destruction and preservation of land bordering on the sea. Chapter VII., which is more than half the book, contains in upwards of 200 pages a detailed description of the south, east, and west coasts of England, and this is the portion of the work which will chiefly interest English geographers. The concluding chapter deals shortly with the coasts of the North of France, Belgium, and Holland. As the work of a practical engineer of considerable experience of sea-defence work, and personally acquainted with a large extent of coast-line, this book will doubtless be read by many persons concerned, whether practically or as students, with the conflict between sea and land.

COMMERCIAL GEOGRAPHY.

"Commercial geography," says the author of the work under review,† "treats of the many influences operating all over the world which promote or retard the

* 'The Sea-Coast.' (1) Destruction; (2) Littoral Drift; (3) Protection. By W. H. Wheeler, M. Inst.C.E. With Illustrations. Longmans. 1902.

† 'A Text-book of Commercial Geography.' By Cyrus C. Adams, B.A., F.A.G.S. London: Hirschfeld Brothers. 1902.

production, transportation, or exchange of the commodities, natural or manufactured, which man consumes or utilizes." The scope of the subject could hardly be better expressed, and it is no objection to this statement of its scope that it leaves room for different modes of treatment in accordance with different points of view. It must be recognized that changes are constantly going on in the nature of the influences referred to, and it might be thought by some that the most instructive and profitable method of studying the subject would be to devote a large amount of attention to the mode in which those influences have operated in the past, by others that the main consideration should be to endeavour to form an estimate of the influences most likely to affect the course of trade in the near future, and by others, again, that our main concern is with the present. Inevitably all these points of view are more or less adopted in any work on commercial geography. In this, as in most other works on the subject, it is the last that predominates, though here and there are to be found in it some very pregnant remarks as to the probable effect of changes now going on or for which the way is being prepared. Even when the main standpoint has been determined, difference of treatment must result from the consideration of the public for whom the work is primarily intended; and, though the present work bears on the title-page only an English imprint, and there is no express statement that an American public has been mainly kept in view, a very cursory examination shows that that is the case. The volume is one of the Twentieth Century Text-books, edited by A. F. Nightingale, Superintendent of High Schools, Chicago. For the public for which it is designed, the book seems to be well proportioned. At the first glance it might appear that an undue proportion was devoted to the United States, which have 132 out of 476 pages allotted to them, 48 of these 476 pages containing matter of a general kind; but on examination one finds that the 132 pages referred to are not really all concerned with the United States, the author having added under that general heading general notes with regard to the production of and trade in the most important commodities throughout the world. The matter is instructive in the best sense, appealing to the intelligence of the reader. In the words of the preface, "the facts of commerce are treated as the effect of conditions that determine the quality and quantity of trade." In most points the information appears to be accurate and up to date. The illustrations are numerous and apt, quite as instructive as the text. The great majority are maps, some of which are coloured. Some, it is true, are on too small a scale, and are overloaded. Not much, for example, can be said to be conveyed to the mind by the mineral maps on pp. 12 and 13, which compare very unfavourably with those on pp. 123–125 showing the situation of the principal deposits of iron ore in the United States. These in themselves speak volumes, and should, with the accompanying text, be examined by every one who wishes to understand the present situation of the iron and steel industry of the world. In such a work as this, it is of course practically impossible to avoid errors here and there. The map of the British coalfields on p. 206 is in several important points inaccurate, both in the way of excess and defect. The figures given for British imports from different countries on p. 213 are not, as stated, those of the "special" trade, but are general imports. In fact, the figures relating to the special trade are not procurable. On p. 221 undue prominence is given to the iron ores of the Harz with reference to the iron industry of the Ruhr basin, and there is no reference to the nearer and much more important deposits of iron ore about the headwaters of the Sieg and Lahn. The spelling Pimlico instead of Pamlico sound (p. 25) is a blunder that would have seemed more natural on this than on the other side of the Atlantic. It would be well to state (p. 130) expressly that the iron-yielding little island in Newfoundland, known as Bell Isle

(or Bell island, whichever be the correct form), is that in Conception bay, so that it may not be confounded with Belle Isle in the straits of the same name. It is a pity that English and American geographers cannot agree at least as to the spelling of the river Hwang-ho. The spelling Hoang-ho adopted in this book is suitable enough for the Portuguese and French languages, from which we adopted it, these having no better means of representing the sound of *w*, but in English it is quite misleading. The last point that we have to notice is a serious one, though it belongs less to geography than to economics, which indeed cannot be ignored in commercial geography. On p. 164 it is stated that "those nations thrive best in trade whose foreign commerce includes a large proportion of manufactures." One cannot but ask, with reference to this statement, what is to be the test of thriving? Has New South Wales not thriven? But when the author goes on to add, "the percentage of profit on manufactures is much larger than on foodstuffs and the raw materials of which goods are made," one is compelled to reply that that is in glaring contradiction with facts. One can only say with truth that in some cases the percentage of profits on manufactures is greater than that on raw materials, etc. But the proposition thus altered to meet the requirements of truth loses all its significance. We trust, therefore, that in the next edition of this work this statement will be not modified, but entirely suppressed. As it stands, it can only serve to lead students seriously astray.

GEO. G. CHISHOLM.

GENERAL.

TOSCANELLI'S MAP.*

The essential point of this elaborate and scholarly, if not always convincing, inquiry is defined by the author (p. 251) as follows: Everything goes to show that the map and letter of Paolo Toscanelli, addressed in 1474 to Fernam Martins, Canon of Lisbon and Privy Councillor of King Affonso V., as well as the copy of these two documents addressed to Columbus, and the undated letter (of similar content but slightly different wording) from the same to the same, are apocryphal, and were fabricated with a definite purpose. This purpose was to suggest to men's minds that Columbus's scientific theories, submitted to, and sanctioned by, a great astronomer, led to the discovery of 1492. Further, Bartholomew Columbus, 'a good cosmographer but a bad Latinist,' was probably the author of the fraud, Christopher being either entirely innocent of the whole thing, or showing himself at an early date (probably before 1494) unwilling to have more to do with the 'machination.' The great discoverer's cosmographical ideas were indeed similar (it is admitted) to those we find in the Toscanelli correspondence; but they were his own, and not derived from the Florentine astronomer; they were elaborated *subsequently* to the discovery of 1492, and what they owed to the books or the thoughts of others was principally through Columbus's reading of the 'Imago Mundi' of Cardinal Peter d'Ailly. Lastly, the story of the nameless pilot who discovered the Antilles by chance, or believed himself to have discovered them, is firmly maintained as true and essential by M. Vignaud, who considers that the suggestions communicated to Columbus by this pilot were the determining cause of his enterprise and its success. At the time of his discovery (1492), according to this view, Columbus had no cosmographical theory, no map with the *imprimatur* of Italian science, but only a chart on which he had indicated, in

* 'La Lettre et la Carte de Toscanelli; étude critique. . . . par H. Vignaud.' Paris: Leroux, 1901. (Recueil de Voyage et de Documents pour servir a l'histoire de la Géographie, XIII^e.-XVI^e. siècles.)

conformity with the ideas of his pilot friend, the position of the islands where the pilot believed himself to have been.

M. Vignaud himself admits that his criticisms are in great part hypothetical; and further, that they are encumbered with certain positive difficulties. If we are in the presence of apocryphal documents, we should be able to find a proper explanation of the forgery, whereas we have only conjectures which, however plausible, are by no means proved, and whose probability cannot be admitted without reserves. The suggestion of Bartholomew Columbus's fraud is quite gratuitous, resting only on his skill in cosmography, his weakness in Latin, and his devotion to his brother The letter of Duke Hercules of Este in 1494 is another stumbling-block. For in this year a great European personage seems to have full knowledge of a past exchange of ideas between Toscanelli and Columbus. Again, the apparent denial of 'any' cosmographical theory to Columbus in the venture of 1492, may be met by the terms of the argument itself, where he is credited with a theory adapted from the un-named pilot; and the view that the Portuguese, before 1474, never sought for the Indies at all, except the India of Prester John, hardly seems to bear in mind various definite passages and indications in thirteenth, fourteenth, and fifteenth century literature and cartography which point to another conclusion.

C. R. B.

THE MONTHLY RECORD.

EUROPE.

The "Landes" of Gascony.—An instructive sketch of the physical conditions prevailing in the district of south-west France known as the "Landes" is given by Dr. Engell, of Copenhagen, in the February number of *Petermanns Mitteilungen*. The writer begins by tracing the geological history of France since early Tertiary times, showing that the "Landes" form one of the most recent areas in the country. He next contrasts the conditions prevailing in this area with those of the rest of France, dividing the country into nine natural provinces on the basis of climate and vegetation, the "Landes" forming a subdivision of the south-western province. Dr. Engell hopes to develop his views as regards these natural provinces—the limits of which he has for the first time endeavoured to lay down approximately—in a subsequent article. Coming to the special subject of the paper, he describes in turn the iron-bound coast-line with its belt of dunes, the heath-lands further inland with their types of vegetation, the scanty animal-life, and the industrial conditions of the district. Among the most interesting points is the extent to which the aspect of the country has been modified by human agency, the once bare and glaring sand of the dunes having given place to a complete covering of *Pinus maritimus*, while in the heath-lands also the extensive planting of trees has interfered with the natural struggle for the mastery between heath and forest, to the advantage of the latter. In the "Landes" proper, population is naturally scanty and scattered, even Arcachon owing its existence to factors not properly connected with the geographical conditions of the district as a whole. The industrial life of the district depends almost entirely on the products of the forests—turpentine, charcoal, timber, etc.—especially the first-named, which is of noted quality, and of which the production is the *raison d'être* of the few factories which the "Landes" possess. It is for the transport of such forest products that the fairly extensive railway system has come into existence.

The Highest Point of Sardinia.—It appears from a note by Attilio Mori in the *Rivista Geografica Italiana* for February last that the uncertainty which has hitherto existed as to the highest point of Sardinia has been removed by surveys carried out in 1900. The value fixed in 1834 by La Marmora, by barometric observations, for the Punta di Bruncu Spina on Mount Gennargentu was for long accepted as giving the altitude of the culminating point of the island. This value (1918 m., or 6293 feet) was found by Prof. Lovisato, who carried out careful measurements with a Fortin barometer in 1892–95, to be too high, and his observations were confirmed soon afterwards by the triangulation of the Geographical Institute, which fixed the height of the Bruncu Spina at 1828·56 m., or 5999 feet. In 1895, however, Prof. Lovisato obtained data which seemed to show that other points of the group slightly exceeded the Bruncu Spina in height, and this has been in part confirmed by recent topographical surveys, which have shown that a point named Perdu Crapias, in the same group, reaches a height of 6017 feet, and is therefore the culminating point of the island, to which it is proposed to give the name Punta La Marmora.

Rivers and Forests in Russia.—In the April number of *La Géographie*, M. Flahault sums up the results of recent research on the interrelation of rivers and forests in Russia, a failure to allow for which has, he says, already seriously affected the *régime* of the rivers, though a movement is now on foot for remedying the evil affected, so far as possible. He holds it as conclusively proved, not only that forests on the mountains at the source of streams exercise an important function in regulating the flow of the latter, but that they are of hardly less importance in the plains traversed by those streams, as helping to bring into circulation, and so convert into an available asset, the water that would otherwise remain in the lower layers of the soil. In Russia the question is of special importance, inasmuch as, in the absence of mountain snows and glaciers, the rivers derive their sole supply from the forests and marshes, which are more and more threatened by the invasion of agriculture. Public attention has been called to the need for action, and something has been done by the planting of bands of forest, intersecting at right angles, and, while protecting the crops from drying winds, checking evaporation and encouraging transpiration and rain-production.

ASIA.

Dr. Philippson's Journey in Western Asia Minor.—The summer of 1901 was spent by Dr. Philippson, the well-known authority on the geography of Eastern Europe, in geological researches in the west of Asia Minor. Some of the results of the journeys, which extended over about 1200 miles, are sketched in the third number of the *Geographische Zeitschrift* for the present year. It was found that considerable alterations are necessary in the geological map of Western Asia Minor, based chiefly on the labours of Chihacheff. Most of the country is composed of late Tertiary fresh-water formations, the marine fossils mentioned by Chihacheff being found in one locality only. Associated with the Tertiary deposits are important volcanic outpourings of like age, the whole region showing signs of great disturbance. The late Tertiary deposits form a comparatively level fringe at the base of the crystalline ranges of Tmolos and Messogis, north and east of which, however, they form horizontal tablelands traversed by deeply eroded valleys, and gradually rising in level towards the Central Anatolian plateau. The whole tableland is broken by rift-valleys and sunk basins, one such area of subsidence—the basin of the Kaister—occurring even in the midst of the crystalline *massif*. This is of later date than the rest, for the crystalline formation here falls directly to the alluvial plain, with no intervening Tertiary deposits, and the upper portions

of several of the valleys have been cut off by the subsidence. The tertiary deposits on the outer margin of Tmolos and Messogis are crowned by masses of loose *débris*, such as are found in Greece and Rhodes, and possibly indicating glacial action.

Journey in Persia.—The last volume of the *Memoirs* of the Russian Geographical Society (General Geography, vol. xxxvi.) is devoted to the report of the well-known zoologist, N. Zarudnyi, on his journey in Eastern Persia. An excursion which the author had made in 1896 having revealed the very great interest of a thorough zoological exploration of Persia, the Academy of Sciences sent out M. Zarudnyi, in 1898, to explore Eastern Persia, so as to connect his explorations with those of Blandford and St. John in Persian Baluchistan. Starting from Askhabad, the author went to Meshed, and explored the northern and western borders of Sistan; he next crossed the Sistan desert, and, proceeding *viâ* Gurmuk and Bazman, reached Bampur, thus connecting his work with that of the English travellers. From Bampur he returned, and when he had reached Askhabad, after an eight months' absence, he brought with him 2700 miles of route survey, as well as a survey of the region situated between Sistan and Bampur, which was very imperfectly represented on our maps, and a very rich zoological collection, which is now in the hands of various specialists. The present volume contains a general description of the journey, well written, and extremely interesting to the naturalist and the geographer.

The Coal Resources of India.—This important question was discussed by Prof. W. R. Dunstan in a paper read in February before the Society of Arts, and printed in the *Journal* of that body for March 21. The lecturer pointed out the ignorance which prevails in this country with regard to the practically inexhaustible supply of coal possessed by India, and the comparatively recent date of all serious attempts to exploit the wealth represented by that supply. In 1880 the total output from the Indian mines was but little over one million tons, of which 98 per cent. was produced in Bengal; while in 1900 the total output had risen to over six million tons, of which nearly five millions were contributed by Bengal. Another indication of the advance which has lately been made is the great drop in the quantity of foreign coal imported into India, which, though varying from 600,000 to 800,000 tons between 1885 and 1895, had fallen to 127,318 tons in 1900, the export of Indian coal showing, on the other hand, a marked rise and reaching a figure exceeding half a million tons in 1900. Before considering the individual coalfields and collieries, Prof. Dunstan sketches the general distribution of coal in India, showing that in the peninsula, including Bengal, the deposits are of Permio-triassic age, while elsewhere, as in Upper Assam, they are still more recent, mostly belonging to the Tertiary age. No considerable quantity of genuine coal is likely to be discovered in Southern India, where the formations are for the most part of older date than those which in India bear coal. The Bengal coal is somewhat bituminous, with rather a high percentage of ash; while the Tertiary coal of Assam is usually soft and bituminous, with a high percentage of volatile constituents. The total coal-area has been estimated at 35,000 square miles, and having regard to the extreme thickness of some of the seams, Prof. Dunstan considers that not only has India a supply which will soon render her independent of other sources, but that it may even be drawn upon by other nations whose coal deposits are now in process of depletion. Although Indian coal has been found to be from 17 to 20 per cent. inferior to British coal of the same type, the best qualities give good results when used on steam-vessels, and the consumption of Indian coal, both by steamers and on the Indian railways, is considered likely to expand rapidly. It is hoped that with improved facilities

for the transport and distribution of coal, an impetus will be given to many industries, and especially to the development of the mineral resources of the country. Prof. Dunstan urges the importance of further inquiries by Government into the extent of India's coal resources.

Malaria Investigations in Bengal.—The sixth series of Reports to the Malaria Committee of the Royal Society, issued in March last, gives some results of investigations in Bengal by Messrs. Stephens and Christophers, among which a paper on the relation of malarial endemicity to "species" of Anopheles is of much interest. An examination of the amount of "malarial endemicity" (*i.e.* the percentage of infection in the cases examined) at various points from Calcutta to the foot of the Himalayas—a distance of 300 miles—showed a steady rise, especially in the last part of the distance, from 0 to 72 per cent. (the latter being as high as in West Africa), the maximum occurring, as might be anticipated by all who know the reputation of the region in question, in the "Duars," or strip of country lying at the foot of the hills. It was also found that this increase in endemicity in the Duars was accompanied by the appearance of a new species of mosquito (to which the name *A. Christophersi* has been given), which also proved to be a good carrier, sporozoits being found in four out of sixty-four specimens examined, or 6·25 per cent.—a rate little lower than that frequently found in Africa. While allowing that more extended observations are necessary, the writers are naturally inclined to believe a connection between the high degree of endemicity and the presence of this mosquito, though they are willing to admit that a part of the effect may be due to the presence of non-immune coolies on the tea-gardens. They are, perhaps, inclined to minimize the climatic and other differences between the Duars and the more southern parts of Bengal, of which all who have lived in both districts for any length of time will be fully conscious. The spot at which the highest rate was observed is shown, on a sketch-map accompanying the paper, in close proximity to a wide tract of jungle—sparsely inhabited until recent years by Meches and other migratory tribes, and quite lately the scene of a considerable Santal immigration, which, no less than the opening of tea-gardens, has led to the turning up of much virgin soil. The possibility of a connection between a high rate of endemicity and the breaking of new ground for cultivation is, however, not discussed in the paper.

Zuallardo's Travels in Palestine.—A description of the work containing the account of Signor John Zuallardo's travels in Palestine in 1586 is given by Colonel C. R. Conder, in the January number of the *Quarterly Statement of the Palestine Exploration Fund* (1902). The volume, now somewhat scarce, was written by Zuallardo in old Italian, and published in Rome in 1587, under the title of 'Il Devotissimo Viaggio di Gerusalemme.' It is divided into five books, of which the third, containing the personal account of Palestine proper, is the most valuable, the others containing general information for intending pilgrims, and a compilation from older accounts of the topography of Palestine. The work is illustrated with engravings of places in Palestine from sketches made by the author, who claims to have been the first to attempt such drawings. Zuallardo left Venice on June 29, 1586, with a party which consisted of nine laymen and eleven clerical members. The sea-passage was broken at Zante, in the Ionian islands, and at Cyprus, where the party transhipped for Tripoli. After two unsuccessful attempts in native boats from both Cyprus and Tripoli, they landed safely at Jaffa on August 25. The best passages from Venice to Jaffa, as a rule, occupied from fifteen to twenty days. Mounted on donkeys, the party set off for Ramleh on August 29, and thence to Jerusalem, which was reached next day. They were not allowed to enter the city, but conducted south to the Franciscan monastery of St. Saviour on Sion.

Daily excursions were made in the neighbourhood of Jerusalem, including a visit to the Church of the Holy Sepulchre, where Zuallardo and two other members of the party were made knights of the Papal Order of the Holy Sepulchre. The journey was continued to Bethlehem and 'Ain Karim, and after another visit to the Greek monastery beside the Holy Sepulchre Church, the party returned to Jaffa on September 9, leaving again on the 11th, and reaching Tripoli on the 16th. Here Zuallardo waited until October 13 for a Venetian ship, and arrived again at Venice on the 23rd, after a rapid but stormy passage.

Expedition to the Tian Shan.—The well-known German geographer, Dr. Max Friederichsen, who published a year or two ago an excellent monograph on the Tian Shan, has undertaken an expedition to the range in company with the Russian botanist, Prof. Sapozhnikof. Especial attention will be paid to the neighbourhood of the Khan Tengri group in the central part of the range.

Tertiary Deposits at Okhotsk.—The fossils brought by Dr. Slyunin from Taui bay in the Sea of Okhotsk, east of the town of the same name, have been examined by Fr. Schmidt, who finds that they belong to the Cretaceous and the Tertiary period. The chief interest of the latter formations consists in their identity with those from the north-western portion of Sakhalin. In both localities we find Miocene sandstones and marls with remains of plants, and, close by, Pliocene sandstones of marine origin. Both have a wide extension, the Pliocene marine deposits covering the northern littoral of the Pacific ocean from California and Oregon, through the Aleutian islands, to Kamchatka, Okhotsk, Sakhalin, and Japan. Their fauna consists of molluscs, partly still living in the Behring sea, and partly extinct. Of the latter, the *Conchocele disjuncta* was found first in California, and subsequently in Japan, Sakhalin, and Okhotsk. The *Mytilus Middendorffi*, Grew., from the Aleutian islands and Sakhalin, has now been found near Okhotsk. As to the *Turritella erosa*, Couth., a small modern representative of this species still lives in various parts of the Arctic sea. The Miocene deposits found on the Okhotsk littoral belong to a formation which is now well known from Sakhalin, California, Oregon, the former Russian America, Japan, and Kamchatka. Among the fossil plants of Okhotsk, the widely spread *Carpinus grandis*, Ung., the *Betula Brogniarti*, Heer, the *Corylus McQuarrii* and *Populus Zaddachi*, Heer, are worthy of notice. Cretaceous deposits have hitherto been found in one spot only. They are similar to the sandstones appearing on Sakhalin (at Due), and are full of shells of the big *Inoceramus Cuvieri*, Goldf., in Okhotsk, while the Sakhalin species belongs to *I. digitatis*, Sow., now described as *I. Schmidtii*, by Michelson (*Verhandlungen of the St. Petersburg Mineralogical Society*, 2nd series, vol. xxxviii. 2).

Lake Baikal.—The members of the hydrographical expedition under Colonel Drizhenko, which is to continue the exploration of Lake Baikal during the present summer, have started for Irkutsk.

The Old States of Sumatra.—In the sixteenth instalment of the 'Geographical Notes,' in which Mr. G. Schlegel has contributed not a little to the elucidation of the historical geography of the far East, the author gives the results of his researches as to the ancient states of the island of Sumatra as described by Chinese and other early writers. The questions to be solved present many difficulties—firstly, from the fact that a knowledge of the old pronunciation of Chinese characters, as well as of local dialects, is a necessary qualification for the task; and, secondly, because not only have the old names undergone great changes in course of time, but in many cases the places to which they were applied seem to have ceased to exist, though known to De Barros and even later authorities of the European period. Thus the powerful fourteenth-century state of Sumundara, from which the name Sumatra itself has come down to us, is represented at the

present day only by the miserable village of Samudra, near Pasei. Palembang, which has long been an important political centre, seems to have three times changed its name during the Christian era. One of the names, the Chinese San-fuh-thsi, to which Mr. Schlegel devotes much attention, as it has puzzled many commentators, is, in his opinion, to be read as Semboja, which, like its variant Kemboja (the modern Cambodia), he explains as the name of the well-known tree with scented flowers, *Plumeria acutifolia*, quoting as analogous instances of the naming of places from trees the existence of many villages called after the celebrated Champak (*Michelia champaka*). The Nakur of the Chinese, inhabited by naked people with apes' faces, is the Necuran of Marco Polo, Vacumeran of Odoric (who says that the natives had dogs' faces), which has wrongly been identified with Nankuri, one of the Nicobars. The Li-te of the Chinese (Lide of De Barros) is a name which has entirely disappeared from modern European maps, although, thanks to De Barros' list of Sumatran states arranged in the order in which they occurred round the coasts, its position can be satisfactorily determined. Another name which has totally disappeared in modern times is that of Baros on the south-east coast, which is mentioned by the Buddhist pilgrim I-tsing in the seventh century A.D. (possibly also by Ibn Khordadbeh as "Balus"), and still appears on one or two European maps of the seventeenth century. It is to be distinguished from the modern Baros on the West Coast, which was known to Marco Polo, in the Arab period, as Fansur, the kingdom in which grew the best camphor in the world.

AFRICA.

Ascents of Mounts Kilimanjaro and Meru.—It is announced in the *Geographische Zeitschrift* that a new ascent of Kilimanjaro was made last autumn by Dr. Carl Uhlig, an official of German East Africa. The unfavourable ice-conditions on Kibo prevented much new work at the top, but Dr. Uhlig obtained a good series of photographs, and during a subsequent excursion was able to add to our knowledge of the southern glaciers, making his way alone to the Decken and Kersten glaciers seen from a distance by Meyer, but never before reached. Botanical and geological collections were also made. Dr. Uhlig also succeeded in ascending to within 100 feet of the summit of Mount Meru, of which no previous traveller had climbed more than the lower half. A wall of rock prevented the ascent to the actual summit, the highest altitude reached being about 15,400 feet. On the way to the mountain Dr. Uhlig examined some small steppe lakes.

Mr. Seton-Karr's Antiquarian Discoveries.—Mr. W. W. Seton-Karr has returned from his ninth journey into Somaliland, having revisited Zalelo, where on previous occasions he discovered such large and perfect stone implements, thought to be Palæolithic, and, if so, completing the chain of evidence connecting Europe with the East as regards intercourse in pre-glacial periods. Mr. Seton-Karr has presented a part of his collections to the Indian Museum at Calcutta, in which he has arranged a new prehistoric gallery. On his way back to Europe he paid a visit to the Nicobar islands.

The Du Bourg Expedition in Abyssinia.—News has lately been published as to the progress of the expedition under M. Du Bourg de Bogas, the departure of which was announced some months back in the *Journal*. From Harrar the French traveller is said to have gone south to Ime, and thence westward into the little-known hilly country inhabited by the Arussi Gallas. It was proposed afterwards to visit the Ogaden country.

Exploration of the Upper Sanga Basin.—The *Mouvement Géographique* for April 13 contains a short account of a journey of exploration in the upper

basin of the Sanga, lately carried out by M. Kerremans, agent of a French company, by which the mapping of that part of the Sanga system has undergone some modification, especially as regards the course of the Kadei, hitherto known chiefly through the journey of Perdrizet. The source of the main western feeder of the stream has been recently located by Baron von Stein in the Kamerun, so that, with M. Kerremans' survey of the middle part of its course, the general features of its hydrography are now known pretty accurately. The Kadei and the Mambere, or eastern branch of the Sanga, both rise in the highlands of Ngaumdere and traverse an elevated tableland sloping towards the south-east, and finally falling in a series of abrupt steps to the great plain of the middle Congo. The part of the Kadei explored by M. Kerremans is broken by an almost continuous series of rapids. The inhabitants of the country belong for the most part to the Baya stock, and show less of the pure negro blood than the other tribes of the Sanga. Mussulman influence is gradually making its way from the north, and the Hausa costume—the cloak with wide sleeves—is not unfrequently seen. The huts are round, as in the Sudan, in the north, but often rectangular in the south.

AMERICA.

Biological Station on the Great American Lakes.—A bill has been brought before the United States Congress for the provision of funds for the establishment of a biological station on the North American lakes. The main objects held in view by the promoters of the scheme, chief of whom is Prof. J. Reighard, are, as we learn from *Science*, the investigation of the problems connected with the whole of the lake fisheries, such as the breeding times, places, and conditions of the fishes, the decrease or increase of special kinds, and generally the study of the conditions and regulations necessary for successful fish-culture.

Proposed Raising of the Level of Lake Erie.—We learn from the *Geographische Zeitschrift* that a scheme has been set on foot in the United States for the raising of the level of Lake Erie by means of a dam at its outlet. The object of such a work would be the deepening of all the Lake Erie harbours to the extent of 3 feet, and of the navigable channel in the St. Clair and Detroit rivers by 2 feet. It would also help to raise the level of Lakes Huron and Michigan, which has fallen of late years by about a foot, owing to the deepening and widening of the rivers leading to Lake Erie, and the construction of the Chicago drainage canal; while the deepening of the Lake Erie harbours and of the rivers above named by any other means would be much more costly, and would only exaggerate the fall in the level of the two upper lakes. The scheme is said to have met with some opposition in Canada, from the idea that the low-water supply of the St. Lawrence would be diminished. It is pointed out, however, that the dam would not alter the total annual discharge from Lake Erie, but only modify its distribution through the year. The scheme has been referred to a mixed Board of American and Canadian engineers.

Bering and Chirikof on the North-west Coast of America, 1741.—Prof. George Davidson, whose researches on the voyages of the early Spanish and English navigators on the north-west coast of America are well known to students of historical geography, has lately undertaken an investigation of the voyages of Bering and Chirikof on the southern coasts of Alaska in 1741, with a view to clearing up the many doubtful points as to the tracks of their vessels and the various points on the coast touched at. The writer considers that Bering's conduct of the expedition has been the subject of unfair criticism, and he takes pains to show the enormous difficulties against which the commander had to contend, and the really wonderful nature of the work accomplished in view of the conditions

under which the task was undertaken. "The difficulties to be overcome," he insists, "demanded a man of supreme self-reliance, great physical ability, and large resources. And it may be asserted that until Bering was attacked by scurvy he was equal to all emergencies." After tracing the former work of Bering and the events which led to his last great expedition, Prof. Davidson examines in detail the courses of the *St. Peter* and the *St. Paul*, commanded by Bering and Chirikof respectively, from their separation in bad weather in about 49° N., 179° W. (after a fruitless search for the mythical land of Jean de Gama, supposed to lie to the east of Japan), to their eventual return to the same meridian after coasting along the Alaskan shores. During the whole of this time the ships never joined company, though their tracks crossed and recrossed each other, and they were at times apparently not many miles apart. From their respective most southerly points in about 176-178° W., both commanders sailed generally north-east until they struck the American coast, the landfall of Chirikof (July 15) being probably at Cape Addington in about 55½° N., while the first point of land sighted by Bering was Mount St. Elias (July 16). Among the special points investigated the most important, perhaps, are—(1) The identity of the bay at which the disaster to Chirikof's boat-party took place; this is considered to be almost certainly Sitka sound. (2) The position of Bering's Cape Hermogenes, which Prof. Davidson identifies with the south point of Sakhlidak island in 57° N., 153° W. The name was, it seems, erroneously bestowed for that of St. Ermolai, on the day of which saint it was sighted. (3) The tracks of the two vessels during the calm weather from August 8 to 30, during which they probably (on the 16th) approached within 15 miles of each other. The grounds of Prof. Davidson's conclusions are not always stated so fully as could be wished, for though he frequently enters into descriptions of portions of the coast as now known, it is not always clear, without turning to the original narratives, how far these supply the means of identification by their own descriptions. He has, however, evidently given much careful study to the questions, and his personal acquaintance with much of the coast makes him particularly well qualified for the task of elucidating the voyages. A large-scale chart shows the tracks of the vessels with much minuteness.

Navigation of the Tanana.—Hitherto, although small vessels have ascended its lower portion, no serious attempt at the navigation of the Tanana, the largest tributary of the Yukon, has been made. The United States consul at Dawson reports that at the end of last autumn, the *Lavelle Young*, of Portland, Oregon, a 500-ton steamer drawing 4 feet of water, navigated it to a distance of 310 miles from its junction with the Yukon. The mouth of the river is nearly 2 miles wide, and is almost closed by a sandbar with a navigable channel of only 4½ feet. Here the current is only 3 miles per hour, but after the first 100 miles, it increased on an average about 2 miles an hour for each succeeding 100 miles. The river is described as having many islands and sandbars, causing the water to divide into numerous channels, somewhat like the Yukon between Fort Hamilton and Circle city. The Valdes trail was known to cross it at 480 miles from the mouth, and it was hoped that this point might be attained, but the vessel grounded at the 310th mile, and no channel could be found with sufficient water to continue. The river has some considerable tributaries. At 60 miles from its mouth it is joined by Baker creek, at 80 miles by the Kantitna, at 86 miles by the Fulvana, and at the lower end of the Bates rapids, some 300 miles up, by the Chenoa. All these streams are navigable for small steamers for a distance of from 50 to 100 miles, and the last-named was ascended for some distance by the *Lavelle Young*. It is stated that the country in the neighbourhood of the Tanana has all the appearance of possessing rich mineral deposits.

Volcanic Eruption in the West Indies.—The appalling disaster which overtook the islands of Martinique and St. Vincent during the first half of May through the eruption of their volcanoes, must rank among the most terrible visitations of the kind, although the destruction wrought has no doubt been surpassed on many recorded occasions, including that of the famous eruption of Krakatau some twenty years ago. In the suddenness and completeness of the ruin, the Martinique catastrophe, at least, lacks no element of impressiveness. It is not easy, from the fragmentary telegraphic intelligence received during the progress of the eruption, to piece together a connected account of the catastrophe, or to trace clearly the date of the first threatenings of disaster. The climax of the eruption on Martinique, by which the whole town of St. Pierre, the largest in the French West Indies, with its 30,000 to 40,000 inhabitants, and almost the whole of the shipping in its roadstead, were completely wiped out of existence in a few short minutes, took place on the morning of May 8, but signs of activity had been shown some days before by Mont Pelée, the highest point of the island, which for many years had reared its verdant summit to a height of 4400 feet, only a few miles from the doomed town. The volcano had been quiescent for just over half a century, the last eruption—and that not of the first magnitude—having taken place in 1851. According to one account, the first flow of lava began on May 3, and in any case this had become so serious before May 6 as to completely destroy the Guérin factory, 2 miles from St. Pierre. On the 7th a state of panic existed in the town, whither the French Governor, M. Mouttet, proceeded with a view to allaying apprehension, being persuaded that the worst was already over. At 8 a.m. on the 8th the climax came, St. Pierre being overwhelmed in a moment by a fiery cataclasm, accompanied, according to some observers, by a poisonous choking whirlwind, which left not a soul alive of the whole population of the town, while thousands were left homeless and destitute in neighbouring parts of the island, and eighteen vessels are said to have been destroyed. Besides the governor and other officials, both the British and American consuls were among the victims. The whole northern end of the island, which became for a time a sea of fire, was afterwards observed to be covered with a silvery-grey coating of ashes. Stones and ashes also fell at Fort La France, some 14 miles off, and intense darkness prevailed in many parts of the surrounding region. Refugees who arrived at Dominica on the 12th, reported that the volcano was still active, new craters being in course of formation, while rivers had overflowed their banks, submerging large areas. The sympathetic eruption of the famous "Souffrière" of St. Vincent, though somewhat less destructive, has still brought a terrible calamity on the island, the deaths being reported to exceed 1600. Earthquake shocks had been felt for some time, when, apparently on May 5, a loud explosion took place, giving rise to a cloud of steam. Many separate outbursts occurred within the next few days, the volcano sending forth clouds of smoke and steam, with stones and ashes, which fell thickly both at Kingston and Georgetown. The whole northern third of the island is said to have been involved, and the Souffrière had the appearance of a scarred smelting furnace, while huge chasms were formed and a new valley opened. The volcano had been much longer quiescent than that on Martinique, the last eruption having been the famous one of 1812—the final act in the prolonged series of far-reaching seismic phenomena described at length by Humboldt in his 'Personal Narrative,' and more briefly in Kingsley's 'At Last.' Since 1812 the mountain had possessed two distinct craters side by side, each occupied by a lake.

The Koppename Expedition in Dutch Guiana.—This expedition, to which reference has more than once been made in the *Journal*, returned to Paramaribo in

November last, having failed to reach the water-parting, and returned as it went, by the Koppename. From the point above the Raleigh falls reached in August (*Journal*, vol. xviii. p. 625), the river was ascended in the boats as far as 4° 9′ 40″ N., beyond which Mr. Stockum made his way in a canoe to 3° 57′ 40″ N., 56° 49′ 40″ W., at which point the stream became a mere brook. This point was 112 miles by river above the Raleigh falls. Another branch of equal size, which entered on the right, was ascended to 3° 59′ 15″ N., 56° 22′ 15″ W., but, owing to the rapid fall in the level of the water, the tributary entering the main stream on the right above the Raleigh falls could only be traced upwards during two days' journey. Meanwhile surveys had been carried out from various hilltops, and the return voyage down the Koppename was begun on October 25.

Regulation of the Paraná River.—The outer part of the La Plata estuary has two waterways, separated by a group of banks. The deeper channel lies along the coast of Uruguay, and is the one used by ocean-going vessels. Those bound for Buenos Aires ascend the estuary to Montevideo, and then make for the Argentine coast, passing over the Barra del Indio, over which there is only 17¾ feet of water, and then follow a channel which runs up to the city. The eastern channel has a fair depth beyond Montevideo, but is blocked below Puerto Sauce. The delta of the Paraná river is formed by the Rio de las Palmas and the Paraná Guazu, which again divides into a number of arms. From Buenos Aires, the most direct route to the Paraná is by the Rio de las Palmas, but owing to a bar in front of its mouth, this entrance can only be used by vessels drawing less than 9 feet, and others have to make a *détour* round the bank called Playa Honda to the Uruguay coast, pass through the Martin Garcia channel, now being dredged out to a depth of 21 feet, and enter the Paraná Guazu. Probably the Rio de las Palmas was at one time the most important mouth of the Paraná, but as the delta was pushed further out, the bulk of the water sought a shorter way to the La Plata, and each of the other mouths became in turn the chief channel. Now the Rio Bravo is preferred to the main Paraná Guaza, its depth being greater. That the Paraná de las Palmas has not been closed at the mouth is due, according to Sr. A. Foster, to the tide which heads against the Argentine coast. His plan for the improvement of the navigation (*Anales de la Soc. Científica Argentina*, tom. lii. No. 5) is to shorten the length of the Las Palmas river by cutting two channels across the bends it makes near its junction with the Paraná Guazu, and thus restore its former pre-eminence. One of these channels would move the junction above the Isla del Dorado, where, with the diminished volume of water, the silt would accumulate, so that the water flowing down the Las Palmas would be further increased. In consequence, the bar of the Rio de las Palmas would, Sr. Foster believes, be moved further out where the waves are larger, and capable of acting more strongly upon it. The length of the Palmas thus rectified would be 60 miles, as compared with 72 for the Guazu or 70 by the Rio Bravo mouth. The distance from Buenos Aires to the Paraná ports would be shortened by about 60 miles, and their foreign trade would pass by the city.

AUSTRALASIA AND OCEANIC ISLANDS.

Memorial to Captain Flinders.—An interesting ceremony was performed in March last by Lord Tennyson, Governor of South Australia, at the summit of Mount Lofty, in honour of the explorer Matthew Flinders, whose celebrated meeting with the French expedition under Baudin on the South Australian coast took place on April 8, 1802, or just a century ago. Mount Lofty has long been crowned with a white obelisk 50 feet high, originally intended as a monument to Flinders, but never formally recognized as such. The ceremony alluded to consisted in the

dedication of the column to the memory of the navigator, and the unveiling of a tablet commemorating the discovery and naming by Flinders of Mount Lofty on March 23, 1802, and the friendly meeting of the officers of the *Investigator* and *Géographe*, commanded by Flinders and Baudin respectively. An illustrated account of the ceremony is given in the *Adelaide Observer* of March 29, which contains the portraits of members of the Flinders family now resident in South Australia.

Exploration in South Australia.—An exploring trip through the western interior of South Australia was undertaken last year by Mr. R. T. Maurice, accompanied by Mr. W. R. Murray, whose brief report on the journey to the Minister of Mines at Adelaide has been printed by order of the House of Assembly, together with a sketch-map of the route followed. The starting-point was the Yalata Station on Fowler's bay, whence the explorers went north to the Paraminna dam in about 29° S., and north-west across the Western Australia border to the Jameson and Rawlinson ranges, returning by a more northerly route along the Mann and Musgrave ranges. The northern part of the Nullabor plains was found to be well grassed, the winter being an unusually good one, and Mr. Murray thinks that in spite of its drawbacks it may in future be utilized for pastoral purposes. It is, however, discouraging to learn that rabbits are getting plentiful, and are already damaging much of the bush herbage. North from the plain the country consists of alternating sandhills and flats, the former being in general the best off as regards water, owing to the non-retentive nature of the subsoil of the flats, which causes the vegetation to be ephemeral in character, even the mulga being unable to thrive. Wherever the blacks have fired the country an excellent young growth springs up after the next rain. The expedition was particularly fortunate in meeting with water, many of the watering-places being apparently permanent, so that in future the task of travelling from the coast to the northern ranges will be much lightened. From a prospector's point of view the country is unpromising until the ranges are reached, but here the geological age and the character of the rocks are said to be distinctly encouraging, quartz reefs which assays proved to contain traces of gold being frequent in the Cavanagh and Rawlinson ranges. Transit, however, entails heavy expenses, and mining operations would probably be more profitable in many districts near Adelaide. No trouble was experienced with the natives, though they were very shy in the west and north-west.

Intercolonial Water Rights.—In the current volume of the *Journal and Proceedings of the Royal Society of New South Wales* (vol. xxxiv. 1900), Mr. H. G. McKinney discusses the subject of "Intercolonial Water Rights as affected by Federation." In explanation of the magnitude and importance of this question, it is pointed out that the drainage area of the Murray river is shared by four colonies as follows: New South Wales over 234,000 square miles, Queensland nearly 105,000 square miles, Victoria nearly 51,000 square miles, and South Australia over 24,000 square miles, making a gross area of 414,000 square miles. In seasons during which the rivers are high, the length of navigable river is 3213 miles. While the Inter-State Commission to be appointed by the Federal Parliament will have charge of the navigation on these rivers, it is not to interfere with "the reasonable use of the waters of rivers for conservation or irrigation." A brief outline is given of the nature of the principal difficulties with which the Inter-State Commission will probably have to deal in connection with the rivers of New South Wales, as also a statement of the present condition of affairs in regard to water rights in this state. In Queensland the question of water rights on the rivers is practically untouched. In New South Wales numerous rights to water have been granted, but on such a limited scale that they cannot be regarded as any

infringement of navigation rights. But in Victoria extensive works for water conservation and irrigation have been constructed, and rights to large quantities of water have been granted; while in South Australia, the water rights which have been granted, though on a much more limited scale than in Victoria, are of greater importance than those granted up till the present in New South Wales. A map illustrating the drainage area of the Murray river accompanies the paper.

Disaster to a French Expedition in New Guinea.—A recent number of the *Deutsche Rundschau für Geographie* gives some particulars of a disaster which has lately happened to a scientific expedition despatched in 1900 by the Paris Journal *La Patrie* to the island groups between Borneo, Celebes and New Guinea. Most of the members of the expedition—four Frenchmen and twenty-one natives—have, according to this account, been murdered by the New Guinea cannibals. On January 1 the ship of the expedition touched at the coast near the British and Dutch boundary, and, meeting with an apparently friendly reception from the natives, the explorers pitched their camp on land. At 1 a.m. they were roused from sleep by a murderous attack, and soon overpowered. One of the party, Dr. H. Rouyer, was stunned by a blow on the head, and on coming to found that he had been bound and carried off by the natives. Fortunately, he had the presence of mind to give no sign of life, and he was soon afterwards rescued by a party from the ship, which, however, came too late to save his companions, among whom was Baron Villars.

POLAR REGIONS.

The Swedish Antarctic Expedition.—The *Antarctic* returned to Tierra del Fuego early in March with a portion of the personnel of the expedition on board, after landing Dr. Otto Nordenskiöld and five companions at the winter station on the east side of Graham Land. Letters received from both the leader himself and Dr. Gunnar Anderson, the biologist of the expedition, give some account of the progress of the work down to the beginning of April. Leaving Staten island—the site of the magnetic observatory established by the Argentine Government for co-operation with the Antarctic Expeditions—on January 6, the *Antarctic* sailed south across Drake strait with a light wind and an almost smooth sea, no ice being in sight during the whole passage. On the 11th the first Antarctic land—King George island in the South Shetlands—came in sight, presenting, with its unbroken mantle of ice and snow, a scene of unsurpassed desolation, which contrasted strongly with the almost tropical luxuriance of the last lands left behind. The ship put into a cove on Nelson island, where a small extent of ground was found free from snow, with a certain amount of vegetation in the shape of mosses, lichens, and algæ, affording a home to many small insects, and even a small beetle, the first ever found in the Antarctic. The poverty of the land was, however, far greater than is ever the case in the Arctic, while on the other hand the sea revealed a wealth of life which could hardly be surpassed, and which included not only shrimps and other of the lower forms, but fish in astonishing numbers, with multitudes of whales and seals. Continuing the voyage, the explorers entered the channel shown by D'Urville on the west side of Louis Philippe land, which they had suspected to be an island, but which proved to be only the extremity of the land-mass known as Graham Land. In order to reach the east coast it was thus necessary to double the northern point, an attempt being then made to follow the coast of King Oscar Land southward. It proved unsuccessful owing to the immense masses of ice which extended to the arctic circle, and after sounding and dredging along the edge of the pack, Dr. Nordenskiöld turned towards the land on February 12 to prepare the winter quarters at Admiralty inlet, Snow Hill Land, south of Cockburn

island. The geological formation is here Mesozoic sandstone associated with basalt, and the ice promised to be favourable for sledge journeys, by which Dr. Nordenskiöld hopes to explore the land during the winter months. He expects to see the *Antarctic* once more about the end of November, and after continuing the work at the station till the end of the year, to be back at the Falklands in February, 1903. The ship left the winter station on February 21, and, after coaling at Ushuaia, proceeded to the Falkland islands *en route* for South Georgia for the purpose of hydrographical and biological investigations.

The New Voyage of the "Windward."—Before starting north this summer to effect a junction with Peary's Expedition, the *Windward* is being thoroughly overhauled and made more suitable for ice-navigation than she has hitherto proved. The old engines being found of insufficient power, they are being replaced by others of more modern type, capable of giving something like 300 H.-P., and a speed of seven knots, or equal to that of the best equipped of the Newfoundland sealing-fleet. The boilers will also be of the modern high-pressure type, and, like the engines, are being installed by Messrs. Marvel & Co. of Newburg, N.Y. It is expected that the work will be completed by June 20, and the ship will then sail immediately, as it is considered that the conditions in Smith sound are more likely to prove favourable earlier in the season than the sound has hitherto been navigated by the Peary expeditions. The explorer is expected to be found at Etah, returned from his dash for the north.

Arctic Exploration.—The members of the Russian Arctic Ocean expedition are already leaving St. Petersburg for Archangelsk. The expedition is under Captain Warneck, and consists of Captains Serguéeff and Morozoff, Lieuts. Yanoff, Brovtsyn, and Kozlaninoff, and Dr. Paliloff. They will first explore the yet unexplored bays of the Murman coast; then, in July, they will start for the Kara sea—the intention being to explore and to map carefully the Kara strait, and to complete the mapping of the Matcchkin Shar; and then, entering the Kara sea, to map its eastern coast (the Yalmal peninsula). If the state of the ice does not permit this work to be done, the mouth of the Pechora will be mapped instead.

GENERAL.

New German Scientific Publication.—It has been decided by the Geographical Institute of the University of Berlin to issue, jointly with "Institut für Meereskunde" (both of which bodies are under the direction of Baron von Richthofen), a publication embodying the results of geographical and oceanographical research in a series of parts to be published at irregular intervals. The first part has already appeared, and deals with the scientific results of the voyage of the *Gauss* to Cape Town, from the reports of several observers; while several other papers are in course of preparation. The publication is of octavo size, and its external form is well worthy of the prospective value of the papers from a scientific point of view. A building is in course of erection for the two institutes, and will contain a museum which is being organized by the "Institut für Meereskunde."

New Colonial Bibliography.—We have received the first numbers of a new publication, issued by the "Union Coloniale Française," which is likely to prove helpful to students and others in view of the flood of colonial literature resulting from the increased attention directed of late years by European nations to the development of their colonial possessions. Under the title *Bulletin Bibliographique Coloniale*, it supplies not merely a catalogue of all the most important publications relating to colonial affairs, but a succinct *résumé* of their contents or general bearing, enabling those who have not the leisure to read the original papers to obtain a general grasp of the results of modern literary activity in this direction.

A New Geographical Society.—During the last Congress of Russian Naturalists the section of geography nominated a special committee for the discussion of all questions relative to the teaching of geography in secondary schools. At the present time a "Society of Earth-knowledge" (*Obschestvo Zemlevedeniya*) has developed out of that committee. It will be connected with the St. Petersburg university, and undertakes to promote the study of scientific *Erdkunde* by means of lectures, congresses, publications, excursions, and so on.

The Artesian Water-supply of Australia.—On p. 576 of the May number, in the discussion on Mr. Cox's paper, the words "with reference to the above, Mr. Cox writes," should be placed before the succeeding paragraph.

OBITUARY.

Sir Andrew Clarke.

Lieut.-General Sir Andrew Clarke, G.C.M.G., C.B., C.I.E., is the third, in less than two months, whose death has removed from the list of Fellows a distinguished servant of the State. He had long been in failing health, and died on March 29, when within four months of completing his seventy-eighth year. Of Sir Andrew Clarke, as of the Marquis of Dufferin and Sir Richard Temple, it may be said with truth that, if he could not claim to rank as an explorer, he was assuredly one of the most widely travelled of men. It was only to be expected, therefore, that he would take an interest in geography, and that such was the case is sufficiently attested by the fact that for over forty years—from 1859—he was a Fellow of the Royal Geographical Society. Born on July 27, 1824, the son of the first Governor of Western Australia, Clarke obtained a commission in the Royal Engineers in 1844. After service in Ireland, Tasmania, and New Zealand, he was appointed, in 1853, Surveyor-General of Victoria. The constitution of that colony, drawn up in 1855, was largely his work, and in the first responsible administration he held office as Minister of Public Lands. Returning to India in 1858, he was sent on a special mission to the Ashantis in 1863, and was subsequently appointed Director of Works to the Navy, in which capacity he materially strengthened the imperial defences. The year 1873 found him in the Straits Settlements, as governor and commander-in-chief, and though he only remained there two years, he succeeded in that time in bringing the Malay States under British protection. Then, after carrying to a successful issue an important mission to Siam, he became Minister of Public Works for India, and having ably filled that post for more than five years, was appointed, in 1882, soon after his return to this country, Inspector-General of Fortifications. In 1886 he was placed on the retired list, and three years later became Agent-General for Victoria, an office which he filled, except for a brief interval, until his death.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1901-1902.

Tenth Ordinary Meeting, April 28, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS:—*Rev. Alfred Armitage, M.A.; Major-General Joseph Herbert Bedford, R.E.; Lieut. T. Tunstall Behrens, R.E.; Major Henry Wightman Benson, D.S.O. (E. Surrey Regt.); Commander John Brown (R.M.S. "Ionian"); Harold E. Byrne; Rev. Wm. Hargreaves Cooper; Lieut. George Rochefort Cox; Rev. Samuel John Deutschberger; Frederick William Emett, F.R.C.I.; William Hunter Gandy; J. Stanley Gardener, M.A.; James Golding; Captain C. V. C. Hobart, D.S.O. (Gren. Guards); Lieut.-Colonel Lovick Bramley Friend, R.E.; Lombard Carter Jones, M.D.; Colonel Fortescue John Nason, D.S.O. (Cameronians); Maurice Newton; Montagu Austin Phillips, F.Z.S.; Captain C. H. D. Ryder, R.E.; Lieut. Basil Heron Shaw-Stewart, R.F.A.; Captain G. E. Tyrrell, R.A.; Henry Hulton Vignoles (late 5th Dragoon Guards); Captain J. F. Whyte (Indian Staff Corps); Joseph Wilson.*

The Paper read was:—

"Trade Routes in Eastern Persia." By the Earl of Ronaldshay and Edward Penton, Esq.

Eleventh Ordinary Meeting, May 12, 1902.—Sir CLEMENTS MARKHAM, K.C.B., F.R.S., President, in the Chair.

ELECTIONS.—*Haden Adam, A.C.P.; Lieut. George H. Arnot, R.N.R.; Henry Gordon Gooch Ashton; Sir Edgar Collins Bochm, Bart.; Dr. Cuthbert Christy; Lieut.-Colonel G. C. Herbert (Royal Fusiliers); Wm. Ellis Jardine (India Civil Service); Rev. John Smith Lontil; Colonel B. Mahon, C.B., D.S.O. (Governor of Kordofan); George Henry Morrell; Dr. Henry White.*

The PRESIDENT said: Before commencing the business of the evening I think I may refer to the expedition of Dr. Nordenskiöld, who is a nephew of that great explorer our late Gold Medalist, Baron Nordenskiöld, and who has already distinguished himself by his explorations and discoveries in Patagonia. He got up a small antarctic expedition with very great difficulty in Sweden, and fitted out a small vessel and planned the work he intended to do admirably. He has had himself put on shore on the eastern coast of Graham's Land, where he intends to winter with one or two scientific men, while the ship returns to do useful work in the seas between Tierra del Fuego and South Shetland. In the mean while, Nordenskiöld will winter on that coast, and no doubt, with his very small means, he will do a great deal of exceedingly good work, both in natural history and in his meteorological observations. We had the great pleasure of giving him a send-off when he came to London on his way.

I would also allude to the relief ship which we are now fitting out to follow the instructions given by Captain Scott, who is now with his gallant companions passing the antarctic winter in some part of those regions to us unknown, and which will be unknown to us until next April. Meanwhile, we have a strong although rather old ship, and we are fitting her out to take those provisions and coals which will be required by Captain Scott, and to succour him in case there has been any accident with the *Discovery*. I may say that all is going well, and that the ship will certainly start at the time fixed, the first week in July.

The Paper read was:—

"On Snow-waves and Snow-drifts in Canada." By Vaughan Cornish, D.Sc., F.G.S.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. = Memoirs, Mémoires.
Met. = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. **Lapparent.**

Le Problème Alpin. Par A. de Lapparent. Extrait du *Correspondant*. Paris: De Soye et Fils, 1902. Size 9½ × 6½, pp. 30. *Presented by the Author.*

Discusses the origin of the Alps.

Alps. **Moore and Kennedy.**

The Alps in 1864. A private journal by A. W. Moore. Edited by Alex. B. W. Kennedy. Edinburgh: D. Douglas, 1902. Size 10 × 6½, pp. xxxvi. and 444. *Maps and Illustrations. Presented by the Publisher.*

This will be specially noticed.

Austria. *Petermanns M.* **48** (1902): 9-11. **Crammer.**

Karren und Dolinen im Riffkalk der Übergossenen Alm. Von Prof. Hans Crammer.

Austria—Bosnia and Herzegovina. *Globus* **81** (1902): 149-150. **Grund.**

Neue Eiszeitspuren aus Bosnien und der Herzegowina. Von Dr. Alfred Grund.

Austria—Istria. *Abrégé B.S. Hongroise G.* **28**, Nos. 5-10 (1900): 24-27. **Czink.**

Lussino, Isola dell' Istria. Prof. L. Czink. (From *Földrajzi Közlemények*, **28** (1900): 173-197).

Baltic—Fauna. *Ymer* **21** (1901): 361-373. **Andersson.**

Ett bidrag till Ostersjöns djurgeografi. Af J. G. Andersson. *With Map.*

On recent investigations of the Baltic fauna.

Baltic Sea. ———

Instructions for Sailing from Kronstadt to Vladivostok and return. II. (In Russian.) St. Petersburg, 1901. Size 9½ × 6½, pp. xvi. and 326. *Chart and Illustrations.*

This part deals with the Baltic and its approaches.

Denmark. **Thomas.**

Denmark Past and Present. By Margaret Thomas. London: A. Treherne & Co., 1902. Size 7½ × 5, pp. x. and 302. *Illustrations. Price* 6*s. net. Presented by the Publishers.*

The first part of this book is descriptive of the towns and country districts of Denmark, which the author recommends to tourists as, "comparatively speaking, a

virgin land, undeteriorated by the extravagances of the millionaire, or the vulgarity of the casual tripper," while possessing natural and historical attractions of special interest to natives of the British isles. The second part gives a sketch of the institutions, literature, and history of the country.

Europe—Geodesy. ———

Veröffentlichung des Königl. Preussischen Geodätischen Institutes. N.F. No. 7. Astronomisch-Geodätische Arbeiten I. Ordnung. Bestimmung der Längendifferenz Potsdam—Pulkowa im Jahre 1901. Berlin: P. Stankiewicz, 1902. Size 11½ × 9, pp. ii. and 56. *Presented by the Institute.*

France. *Petermanns M.* **48** (1902): 30–38. **Engell.**

Beiträge zur Kenntnis der geographischen verhältnisse von "Les Landes." Von Dr. M. C. Engell.

See note in the Monthly Record (*ante*, p. 750).

France. *Ann. G.* **11** (1902): 24–42. **Fabre.**

L'érosion pyrénéenne et les alluvions de la Garonne. Par L. A. Fabre. *With Plates.*

France. *Globus* **80** (1901): 297–302, 315–323, 334–339. **Friederichsen.**

Beiträge zur geographischen Charakteristik der Bretagne und des französischen Zentralmassivs. Von Dr. Max Friederichsen. *With Illustrations.*

An instructive study in physical geography.

France. *B.S.G. Com. Bordeaux* **28** (1902): 65–81. **Pawlowski.**

La Gironde et le Golfe de Gascogne au XVI^e^ siècle. Extraits du *Routier de la Mer* de Pierre Garcie, dit Ferrande, publiés et annotés par A. Pawlowski.

A note on the "routiers" of Garcie was given in the *Journal* for September, 1901 (p. 315).

France—Burgundy. *Ann. G.* **11** (1902): 43–53. **Girardin.**

Le relief des environs de Dijon et les principales formes topographiques de la Bourgogne. Par Paul Girardin. *With Map and Plates.*

France—Gascony. *Naturw. Wochenschrift* **1** (1902): 277–282, 292–295. **Engler.**

Aus den Dünen und Landes der Gascogne. Von Arnold Engler. *With Illustrations.*

France and England. *C. Rd.* **134** (1902): 786–788. **Ballore.**

Sur l'influence sismique des plissements armoricains dans le nord-ouest de la France et dans le sud de l'Angleterre. Note de M. F. de Montessus de Ballore.

Germany. *Vierteljahrshefte G. Unterricht* **1** (1902): 140–143. **Günther.**

Das Ries. (Eine geologisch-geographische Skizze nach Branco und Fraas.) Von Prof. Dr. S. Günther.

Germany. *Petermanns M.* **48** (1902): 38–40. **Hansen.**

Küstenänderungen in Rüstringen und Wangerland. Von Prof. Dr. R. Hansen. *With Map.*

Germany. **Kirchhoff and Hassert.**

Bericht über die neuere Litteratur zur deutschen Landeskunde. Herausgegeben im Auftrag der Zentralkommission für wissenschaftliche Landeskunde von Deutschland. Von Prof. Dr. Alfred Kirchhoff und Prof. Dr. Kurt Hassert. Band I. (1896–1899). Berlin: Alfred Schall, 1901. Size 11 × 8, pp. 254.

This publication is intended to supplement the *Bibliotheca Geographica Germaniæ* brought out under the auspices of the same body in 1896, by dealing with the literature which has appeared since that date. It differs from the former work in giving, not only the titles, but an indication of the contents of the several works, and will prove of much value to students in view of the large extent of modern literature on German geography.

Russia—Finland. *Fennia* **18** (1900–1901), No. 3: 1–10. **Neovius.**

La densité de la population en Finlande, d'après une méthode cartographique nouvelle. Par E. R. Neovius. *With Maps.*

Russia—Finland. *Fennia* **10** (1894–1901), No. 2: 1–242. ———

Katalog öfver trigonometriska och astronomiska punkter i södra Finland intill 61sta breddgraden bestämda åren 1860–1886 af Ryska Generalstabens Topografiska Afdelning. *With Map.*

Russia—Kola Peninsula. *Fennia* **16** (1900), No. 1 : 1–151. **Ramsay.**

Ueber die Geologische Entwicklung der Halbinsel Kola in der Quartärzeit. Von Wilhelm Ramsay. *With Map and Plates.*

Spain—Mountain Structure. *C. Rd.* **134** (1902) : 493–495. **Nicklès.**

Sur l'existence de phénomènes de recouvrement dans la zone subbétique. Note de M. René Nicklès.

Switzerland—Lake of Geneva. **Forel.**

F. A. Forel. Le Léman. Monographie Limnologique. Tome Troisième, Première livraison. Lausanne : F. Rouge, 1902. Size 10 × 6½, pp. 412. *Map and Illustrations.*

This part of Prof. Forel's great work treats of biology, the section dealing with the regional association of organisms being especially valuable from a geographical point of view. The second part of vol. 3 will deal with the historical, archæological, and economic aspects of the lake, and will complete the work.

Turkey. *Quarterly J. Geolog. S.* **58** (1902) : 150–162. **English.**

Coal- and Petroleum-Deposits in European Turkey. By Lieut.-Colonel Thomas English. *With Map and Illustration.*

United Kingdom. *Geolog. Mag.* **9** (1902) : 67–69. **Callaway.**

The Zigzag Course of the Cheddar Gorge. By Dr. C. Callaway. *With Diagram.* See note in the April number (*ante*, p. 501).

United Kingdom—England. **Avebury.**

The Scenery of England and the Causes to which it is due. By the Right Hon. Lord Avebury. London : Macmillan & Co., 1902. Size 9 × 6, pp. xxvi. and 534. *Maps, Diagrams, and Illustrations. Price* 15*s. net. Presented by the Publishers.*

This will be the subject of a review.

United Kingdom—England. **Baddeley.**

Thorough Guide Series. Bath and Bristol and Forty Miles Round. London : Dulau & Co., 1902. Size 6½ × 4½, pp. xvi. and 268. *Maps and Plans. Price* 5*s. net. Presented by the Publishers.*

This is a valuable addition to the well-known series of 'Thorough Guides.' Although the district dealt with lacks, as a whole, the scenic interest of some of the more popular tourist resorts, it is, as the author remarks, a hardly-to-be-surpassed example of rich rural and characteristic English landscape, while the architectural monuments, to which full justice is done, give an additional interest to it. The excellent contoured maps by Bartholomew, one of which shows the Wye valley, are, as in other guides of the series, a valuable supplement to the descriptions.

United Kingdom—England. *Symons's Meteorolog. Mag.* **37** (1902) : 1–4. ——

Dust Shower in the South-West of England. *With Map.*

The map shows all the places at which a deposit of dust was noticed in January.

United Kingdom—London. *G. Teacher* **1** (1902) : 67–76. **Davies.**

The Geography of Greater London. By A. M. Davies. *With Maps.*

United Kingdom—Scotland. *Scottish G. Mag.* **18** (1902) : 24–29. **Niven.**

On the Distribution of certain Forest Trees in Scotland, as shown by the Investigation of Post-Glacial Deposits. By Walter N. Niven. *With Map.*

United Kingdom—Scotland. *B.S.G. Lyon* **17** (1902) : 545–559. **Privat-Deschanel.**

Les influences géographiques dans la Répartition de la Population en Écosse. Par M. Paul Privat-Deschanel.

United Kingdom—Wales. *Quarterly J. Geolog. S.* **58** (1902) : 35–36. **Codrington.**

Note on a Submerged and Glaciated Rock-Valley recently exposed to view in Carmarthenshire. By Thomas Codrington. *With Section.*

Western Europe. *B.S.G. Com. Bordeaux* **28** (1902) : 1–20. **Desbats.**

La mission de la Société d'océanographie en Espagne et en Portugal. Par Gabriel Desbats. *With Map and Illustrations.*

Also separate copy, entitled "Mission Océanographique dans le Golfe de Gascogne." Bordeaux, 1902.

The "Oceanographical Society of the Gulf of Gascony" was founded about two years ago for research on the meteorology, hydrology, and marine biology of the coasts of Western Europe. The voyage here described was carried out in 1900–1901.

ASIA.

Arabia—Farsan Islands. *Asien* **1** (1901): 31–33. **Plüddemann.**

Kohlenstationen und die Farisan-inseln. Von Kontre-Admiral Z. D. M. Plüddemann. *With Map.*

Aral Sea. *Zemlevedenie* **8** (1901): 1–28. **Berg.**

Sketch of the Physical Geography of the Aral Sea. By L. S. Berg. [In Russian.] *With Maps and Illustrations.*

See the note and map in the April *Journal* (p. 503).

Armenia. *Asien* **1** (1901–1902): 6–9, 27–31, 71–74. **Zimmerer.**

Armenien. Eine Kulturhistorische Studie. Von Prof. Dr. H. Zimmerer.

Asia. *G.Z.* **7** (1901): 609–625, 677–692. **Kürchhoff.**

Eisenbahnen und Eisenbahnpläne in Klein- und Mittel-Asien, Persien und Afghanistan. Von Oberleutnant a. D. Kürchhoff.

China. *P.R.G.S. Australasia, South Australian Br.* **4** (1901): 91–109. **Eitel.**

China and the Far Eastern Question. By Rev. Dr. Eitel.

China. *Vierteljahrshefte G. Unterricht* **1** (1902): 113–122. **Immanuel.**

Die Landschaft Kwantung (Südmandschurei) im russischen Besitze. Von Hauptmann Immanuel.

China. **Little.**

The Land of the Blue Gown. By Mrs. Archibald Little. Second Impression. London: T. Fisher Unwin, 1902. Size 9 × 6, pp. xx. and 370. *Illustrations. Price* 21*s. net. Presented by the Publishers.*

Mrs. Little's lively sketches of residence and travel in China, from the treaty ports to the far western interior, give an excellent insight into the life and characteristics, both of the Chinese themselves and of the European colonies. She shows herself a shrewd observer of men and manners, and her opinions carry weight from the impartial spirit which she has evidently brought to bear on her inquiries. In its external form the book shares the disadvantages attaching to so many modern books from the heavily loaded paper which publishers persist in using, to the great annoyance of their clients among the reading public.

China. *Questions Dipl. et Colon.* **13** (1902): 272–277. **Madrolle.**

La Navigation à vapeur dans le Se-tch'ouen. Par Cl. Madrolle. *With Map.*

China. **Reclus.**

Élisée et Onésime Reclus. L'Empire du Milieu. Le climat, le sol, les races, la richesse de la Chine. Paris: Hachette & Co., 1902. Size 9 × 7, pp. 668. *Maps and Illustrations. Presented by the Publishers.*

This is a companion volume to that on South Africa brought out last year. The authors have done good service by supplying an up-to-date compendium of the geography, climate, people, and resources of parts of the world on which so much attention is focused at present. The present volume is perhaps the most complete work of reference on China that has yet appeared. There are numerous sketch-maps, and a bibliography of the most important works on China which have appeared since 1882, from which, however, one or two are missing that we should have expected to find mentioned, *e.g.* M. Bonin's accounts of his two journeys across China.

China—Canton. **Ferguson.**

Indian Antiquary **30** (1901): 421–451, 467–491; **31** (1902): 10–32, 53–65.

Letters from Portuguese Captives in Canton, written in 1534 and 1536. With an introduction on Portuguese Intercourse with China in the First Half of the Sixteenth Century. By Donald Ferguson.

China—Kiauchou. *Globus* **81** (1902): 229–236. ———

Tsingtau und Kiautschou. (Ein Kulturbild aus Deutsch-China.) *With Illustrations.*

China—Macao. *B. Comité l'Asie Française* **2** (1902): 22–24. ———

L' "extension" de Macao. Par R. C. *With Map.*

Chinese Empire. **Krahmer.**

Petermanns M. **47** (1901): 90–94, 160–163, 182–187, 205–208, 237–239, 260–262.

Nachrichten von der Expedition P. K. Koslows. Von Gen. Krahmer.

Chinese Turkestan. **Stein.**

Preliminary Report on a Journey of Archæological and Topographical Exploration in Chinese Turkestan. By M. A. Stein. London: Printed by Eyre & Spottiswoode, 1901. Size 11½ × 9, pp. 78. *Plates.*

A sketch of the topographical work done by Mr. Stein was given in the *Journal* for April, 1901 (p. 409). The present report gives much interesting information on the antiquarian discoveries made by the author, the plates showing (besides general views of the sites) specimens of carvings, vases, manuscripts and other objects, the most remarkable being, perhaps, the colossal relievo-figures found at Rawak, which seem to date from the period of the so-called Græco-Buddhist art.

French Indo-China. **Padaran.**

B. Comité l'Asie Française **1** (1901): 185–191, 243–249, 282–290, 379–383; **2** (1902): 78–84.

Les Possibilités économiques de l'Indo-Chine. Par Pierre Padaran. *With Map.*

French Indo-China. *B. Comité l'Asie Française* **2** (1902): 17–22. **Xieng-La.**

Le Mékong voie de pénétration. Par Xieng-La.

French Indo-China—Darlac. ———

B. Comité l'Asie Francaise **2** (1902): 106–110.

Le Darlac, une province laotienne. Par C. M. *With Map.*

Malay Archipelago—Java and Sumatra. **Giesenhagen.**

Auf Java und Sumatra. Streifzüge und Forschungsreisen im Lande der Malaien. Von Dr. K. Giesenhagen. Leipzig: B. G. Teubner, 1902. Size 9½ × 7, pp. x. and 270. *Map and Illustrations. Price* 12*s.*

This will be noticed with other books on the Malay archipelago.

Malay Archipelago—Sumatra. **Kan.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 270–284.

Die neuesten Fortschritte der Kenntnis von Sumatra. Von Prof. Dr. C. M. Kan.

Persia. **Adams.**

Persia by a Persian. Personal Experiences, Manners, Customs, Habits, Religious and Social Life in Persia. By Rev. Isaac Adams. 1900. Size 9 × 6, pp. 536. *Illustrations.*

Contains details on the customs and modes of life in Persia not to be found in ordinary books of travel, and of which no one but a native of the country could treat adequately.

Persia. **Stileman.**

The Subjects of the Shah. By the Rev. Charles Harvey Stileman, M.A. London: Church Missionary Society, 1902. Size 7½ × 5½, pp. viii. and 96. *Illustrations. Presented by the Author.*

Persia. *Zap. Imp. Russ. G.S. (Gen. G.)* **36** (1901): pp. 362. **Zarudnoï.**

Voyage en Perse Orientale. Par N. Zarudnoï. [In Russian.]

Persia—Susa. *Imp. and Asiatic Quarterly Rev.* **12** (1901): 330–356. **Boscawen.**

Explorations at Susa. By W. St. Chad Boscawen.

Persia and Turkey. *J.R. Asiatic S.* (1902): 49–74. **Le Strange.**

Description of Persia and Mesopotamia in the year 1340 A.D., from the Nuzhat-al-Kulub of Hand-Allah Mustawfi, with a summary of the contents of that work. By G. Le Strange. *With Map.*

Russia. *Mém. S. Imp. Russe G., Sec. G.* **31** No. 2 (1901): pp. 492. **Hiekisch.**

Catalogue des données hypsométriques de la Russie d'Asie et en partie des pays limitrophes. Par M. le Dr. C. Hiekisch. [In Russian.]

See note, *ante*, p. 634.

Russia—Caucasus. *B. Caucasian Museum* **1**, No. 4 (1901): pp. 154. **Satunin.**

On the Mammals of the Steppes of the North-Eastern Caucasus. By K. A. Satunin. [Russian and German.] *With Maps.*

Russia—Siberia. **Aulagnon.**

La Sibérie Économique. Considérée plus spécialement dans sa partie Cisbaïkalienne. Par Claudius Aulagnon. Préface par M. Frédéric Passy. Paris: Guillaumin et Cie., 1901. Size 10 × 6½, pp. xii. and 232. *Illustrations. Price* 5*s.* 6*d.*

A useful study of the resources—mineral, vegetable, and animal—of Siberia, though

primarily written from the point of view of French trade. While decidedly sanguine as to the future of the country, the author seems to have arrived at his conclusions as a result of careful and impartial consideration.

Russia—Siberia. *J.R. United Service I.* **46** (1902): 18-38. **Bonar.**
From Japan to Europe by the Trans-Siberian Route. By H. A. Bonar. *Map.*
The journey was made in 1900 by the Amur and the railway.

Russia—Siberia. *Rev. G.* **50** (1902): 36-54. **Weulersse.**
Le Haut-Amour et la Chilka (Notes de voyage). Par Georges Weulersse.
The journey was made in August, 1900.

Russia—Siberian Railway. *B. Comité l'Asie Française* **1** (1901): 366-375. **Bidou.**
L'Achèvement du Transsibérien. Par Henry Bidou. *With Map.*

Siam. ———
Imp. and Asiatic Quarterly Rev. **11** (1901): 331-343; **12** (1901): 120-133.
A History of the French Missions to Siam. By "Pinya."

Turkey. *Missions Belges* **4** (1902): 12-27. **Lammens.**
Le chemin de fer de La Mecque et les musulmans indiens. Par Henri Lammens, S.J. *With Illustrations.*
On the project for a line from Damascus to Mecca.

Turkey—Asia Minor. *Deutsche Rundschau G.* **24** (1902): 211-218. **Borée.**
Hierapolis. Wort und Bild von W. Borée. *With Illustrations.*

Turkey—Asia Minor. *J. of T. Victoria I.* **33** (1901): 226-241. **White.**
A Visit to the Hittite Cities Eyuk and Boghaz. By Rev. G. E. White. *With Illustrations.*

Turkey—Asia Minor. *Globus* **81** (1902): 58-62. ———
Die Höhlenlandschaften Kappadoziens. *With Illustrations.*

Turkey—Kurdistan. *La G., B.S.G. Paris* **4** (1901): 393-402. **Galland.**
Dans le Kurdistan. Par P. Galland, O.P.

Turkey—Palestine. *J. of T. Victoria I.* **33** (1901): 242-252. **Wilson.**
Recent Investigations in Moab and Edom. By Major-General Sir Charles W. Wilson, K.C.M.G., etc.
On observations made during a tour in 1899.

Western Asia—Historical. **Belck.**
Beiträge zur alten Geographie und Geschichte Vorderasiens. Von Dr. Waldemar Belck. II. Leipzig: Eduard Pfeiffer, 1901. Size 9½ × 6½, pp. 57-112.
Contains notes on points connected with the early geography of Assyria and Armenia, on the Peutinger table, etc.

AFRICA.

Abyssinia. *M.G. Ges. Wien* **44** (1901): 291-311. **Bieber.**
Aitjôpija. Eine afrikanische Grossmacht und ihr Werden. Von Friedrich J. Bieber.

Abyssinia. **Powell-Cotton.**
A Sporting Trip through Abyssinia. A Narrative of a Nine Months' Journey from the Plains of the Hawash to the Snows of Simien, with a description of the Game, from Elephant to Ibex, and notes on the manners and customs of the natives. By P. H. G. Powell-Cotton. London: Rowland Ward, 1902. Size 9 × 6¼, pp. xxiv. and 532. *Map and Illustrations. Price* 21*s. net. Presented by the Publisher.*
Mr. Powell-Cotton started from Zeila with the Harrison-Whitehouse Expedition, but soon after reaching Addis Ababa decided to leave the party and make his way northwards through Abyssinia. The journey, described in the present work, was of some interest as leading through parts of the country but little visited by Englishmen within recent years. It is hardly correct, however, to say that it led "through regions which no European foot had trod for generations," and in the bibliography given in Appendix 4 we miss such names as D'Abbadie, Rohlfs, Heuglin, Cecchi and other Italians, to say nothing of less-known travellers. The work is by no means solely a record of sport, though this was the primary object of the journey.

Abyssinia—Gold. **Bruchhausen.**

Beiträge Kolonialpolitik **3** (1901-1902): 260-262.

Abessinien als Goldland. Von Major A. D. Karl von Bruchhausen.

Africa. **Sievers and Hahn.**

Afrika, Zweite Auflage, nach der von Prof. Dr. Wilhelm Sievers verfassten ersten Auflage umgearbeitet und erneuert von Prof. Dr. Friedrich Hahn. (Allgemeine Länderkunde . . . herausgegeben von Prof. Dr. Wilhelm Sievers. Zweite Auflage.) Leipzig und Wien: Bibliographisches Institut, 1901. Size 10½ × 7, pp. xii. and 682. *Maps and Illustrations. Presented by the Publishers.*

This useful work of reference has been entirely remodelled and brought up to date in the present edition.

Angola. *B.S.G. Lisboa* **18** (1900): 611-642. **Giraul.**

Idéas geraes sobre a colonização europeia da provincia de Angola. Pelo Visconde de Giraúl.

Azores. *XXVII. Jahresb. V. Erdk. Dresden* (1901): 145-180. **Ruge.**

Valentin Ferdinands Beschreibung der Azoren. Von S. Ruge.

The author of this manuscript account of the Azores was a German who came to Portugal at the end of the fifteenth century.

British East Africa. *J. S. Arts* **50** (1902): 229-241. **Whitehouse.**

To the Victoria Nyanza by the Uganda Railway. By Commander B. Whitehouse. *With Map.*

Notes on surveys on the shores of the Victoria Nyanza, and on the country traversed by the Uganda railway.

British West Africa. **George.**

The Rise of British West Africa, comprising the early history of the Colony of Sierra Leone, the Gambia, Lagos, Gold Coast, etc., etc. By Claude George. Part I. London: Houlston & Sons, 1902. Size 9 × 6, pp. 1-96. *Price* 2*s. Presented by the Publishers.*

This work, which is to be complete in five parts, is somewhat on the same lines as the West African volume of Lucas' 'Historical Geography of the British Colonies,' though entering more fully into details.

Cape Colony. Lovedale Mission. **Young.**

African Wastes Reclaimed. Illustrated in the story of the Lovedale Mission. By Robert Young. London: J. M. Dent & Co., 1902. Size 7½ × 5, pp. xii. and 268. *Portraits and Illustrations. Price* 4*s.* 6*d. net. Presented by the Publishers.*

The Lovedale Mission was founded early in the nineteenth century by the Glasgow Missionary Society, in the extreme east of Cape Colony, as it then was.

Central Africa. *Petermanns M.* **48** (1902): 12. **Langhans.**

Kupfer und Eisen in Marungu. Nach handschriftlichen Bemerkungen Weisser Väter. Von Prof. Paul Langhans. *With Map.*

Central Africa. *M. G. Ges. Hamburg* **17** (1901): 55-62. **Moisel.**

Begleitworte zu der karte "Dr. F. Stuhlmann's Aufnahmen im Gebiet des Albert- und Albert-Edward-Sees." Von Max Moisel. *With Map* (2 *Sheets*).

The map has already been noticed in the *Journal* (*ante*, p. 536).

Congo. **Droogmans.**

Notices sur le Bas-Congo. Annexes aux feuilles 1 à 15 de la Carte de l'État Indépendant du Congo à l'échelle du 100,000e. Par Hubert Droogmans. Bruxelles: Imp. Vanbuggenhoudt, 1901. Size 11 × 7½, pp. xx. and 302. *Map. Presented by the Author.*

Accompanies the large scale-map of the lower Congo Region noticed in the *Journal* for December last. Much useful information is given for each sheet of the map in turn.

Congo State. *Mouvement G.* **19** (1902): 55-59. **Wauters.**

Le chemin de fer des Stanley-Falls. Par A. J. Wauters. *With Map.*

See note in the March number (p. 374).

Egypt. ———

Ministry of Public Works. A List of Publications, Maps, and Plans, published by the Public Works Ministry up to 31st December, 1901. Cairo, 1901. Size 9½ × 6½, pp. 32.

Egypt. *B. S. Khédiv. G.* **5** S. (1901): 619–625. **Boddy.**

Les sources de Moïse. Note d'Alexandre A. Boddy.

Egypt—Nubia. **Chantre.**

Les Barabra. Esquisse ethnographique et anthropométrique. Par Ernest Chantre. Lyon: A. Rey & Cie, 1901. Size 9 × 5½, pp. 20. *Illustrations.*

Madagascar. *Rev. Madagascar* **4** (1902): 34–54. **Grandidier.**

Histoire de la découverte de l'île de Madagascar par les Portugais (pendant le XVI^e^ siècle). Par Alfred Grandidier. *Also separate copy, presented by the Author.*

Madagascar. *J. of T. Victoria I.* **33** (1901): 334–361. **Shaw.**

The Arab Immigration into South-East Madagascar. By Rev. George A. Shaw.

Morocco. *Imp. and Asiatic Quarterly Rev.* **12** (1901): 306–329. **Montet**

A Special Mission to Morocco. By Prof. Dr. E. Montet.

Natal. **Anderson.**

Natal. Surveyor-General's Department. First Report of the Geological Survey of Natal and Zululand. By William Anderson. Pietermaritzburg, 1901. Size 12 × 8½, pp. 138. *Maps and Plates. Presented by the Surveyor-General of Natal.*

This will be specially noticed.

Nigeria. *J. African S.* **1** (1902): 160–173. **Mockler-Ferryman.**

British Nigeria. By Lieut.-Colonel A. F. Mockler-Ferryman. *Also separate copy presented by the Author.*

North-East Africa. *Rev. Française* **27** (1902): 129–146. **Demanche.**

Le chemin de fer français d'Éthiopie. Par G. Demanche. *With Map.*

North-East Africa. *Z. Ges. Erdk. Berlin* (1902): 7–32. **Neumann.**

Von der Somali-Küste durch Süd-Äthiopien zum Sudan. Von Oskar Neumann. *With Map and Illustrations.*

Portuguese West Africa—Angola. **Ravenstein.**

The Strange Adventures of Andrew Battell of Leigh, in Angola and the Adjoining Regions. Reprinted from 'Purchas His Pilgrimes.' Edited, with Notes and a Concise History of Kongo and Angola, by E. G. Ravenstein. London: Printed for the Hakluyt Society, 1901. Size 9 × 5½, pp. xx. and 210. *Presented by the Hakluyt Society.*

A notice of this appears elsewhere.

Rhodesia. **Hall and Neal.**

The Ancient Ruins of Rhodesia. (Monomotapæ Imperium.) By R. N. Hall and W. G. Neal. London: Methuen & Co., 1902. Size 9 × 6, pp. xxviii. and 396. *Maps, Plans, and Illustrations. Price* 21*s. net. Presented by the Publishers.*

This was reviewed in the April number of the *Journal.*

Sahara. *C. Rd.* **133** (1901): 1265–1266. **Deburaux.**

Sur un projet de traversée du Sahara par ballon non monté. Note de M. Deburaux.

As an experiment it is proposed to make the first attempt with an empty balloon, the aeronaut's place being taken by automatic apparatus.

Sahara. **Laquière.**

Renseignements Colon., Comité l'Afrique Française, No. 1 (1902): 1–35.

La Colonne Servière au Tidikelt, au Touat et au Gourara (21 mai—18 août 1900): le Carnet de route du commandant Laquière.

La deuxième reconnaissance du général Servière au Gourara et au Touat. Par le Commandant Laquière. *With Maps and Illustrations.*

South Africa. **Guyot.**

Yves Guyot. Les indigènes de l'Afrique du sud. Les Vaalpens. (Extrait des *Bulletins de la Société d'Anthropologie de Paris,* 5^e^ série, t. ii. fasc. 4, 1901.) Paris, 1901. Size 10 × 6½, pp. 16. *Presented by the Author.*

South Africa. *J. African S.* **1** (1902): 215–229. **Lacy.**

A Century of Exploration in South Africa. By George Lacy.

The writer shows a singular incapacity to gauge the relative importance of different explorations, and falls into error, besides, as to matters of fact, as is shown in a note by Mr. Selous which follows the paper.

South Africa. *J. African S.* **1** (1902): 174–183. **Peters.**

Ophir and Punt in South Africa. By Dr. Carl Peters. *With Illustrations.*

Dr. Peters' views have been refuted in Prof. Keane's recent work on Ophir.

South Africa. *T.S. African Philosoph. S.* **11** (1901): 189–206. **Sclater.**

Notes on the so-called "Post-Office Stone" and other inscribed stones preserved in the South African Museum and elsewhere. By W. L. Sclater.

On inscriptions dating from the early part of the seventeenth century recording visits of ships, etc.

Tanganyika. *Petermanns M.* **47** (1901): 275–278. **Stromer.**

Ist der Tanganyika ein Relikten-See? Von Dr. Ernst Stromer.

See note in the Monthly Record for April (p. 507).

West Africa. *Scottish G. Mag.* **18** (1902): 30–34. **Speak.**

The Gold-producing Region of West Africa. By S. J. Speak.

West Africa—Currency. *Globus* **81** (1902): 12–13. **Schurtz.**

Afrikanisches Steingeld. Von H. Schurtz. *With Illustrations.*

The small stone discs here referred to as lately discovered in the Gold Coast—Togo borderland—are said to have been used as currency before the introduction of cowries. The only known region where stone currency is actually in use is that of the Caroline islands.

West Africa—Flora. **Hiern.**

Catalogue of the African Plants collected by Dr. Friedrich Welwitsch in 1853–61. Part iv. Dicotyledons. Lentibulariaceæ to Ceratophylleæ. By William Philip Hiern. Pp. 785–1035. Vol. ii. part ii. Cryptogamia, pp. 261–565. London: 1900–1901. Size 8½ × 5½. *Presented by the Trustees of the British Museum.*

The four parts dealing with the Dicotyledons are regarded as vol. i., which is now complete, as is also vol. ii., which contains a general index to the whole.

West Africa—Historical. *Verh. Naturforsch. Ges. Basel* **13** (1901): 1–141. **Henning.**

Samuel Braun aus Basel der erste deutsche wissenschaftliche Afrikareisende. Beitrag zur Erforschungsgeschichte von Westafrika. Von Dr. Georg Henning. *With Map.*

This German traveller visited the whole Guinea Coast, in the years 1610–20, and wrote an account of his travels, which was published at Basel in 1624.

West Africa—Historical. **Mees.**

Dr. Jules Mees. Les Manuscrits de la "Chronica do descobrimento e conquista de Guiné" par Gomes Eannes de Azurara, et les sources de João de Barros. Lisboa: Livraria Ferin. Size 10 × 6½, pp. 14.

West Africa—San Thomé. *B.S.G. Italiana* **3** (1902): 40–59. **Fea.**

San Thomé. Del Leonardo Fea.

NORTH AMERICA.

Alaska. *B.S.R. Belge G.* **25** (1901): 389–409. **Pasteyns.**

Alaska. Par Fr. Pasteyns.

A compilation from published works.

Alaska—Copper River. *T. and P.G.S. Pacific* Ser. ii. **1** (1902): 45–50. **Davidson.**

The Copper River of Alaska. By George Davidson.

On the history of the name "Atna" as applied to the Copper river. It dates from the journey of the trader Nagáef in 1781.

Alaska and Canadian. *J. Franklin I.* **153** (1902): 161–192. **Balch.**

The Alasko-Canadian Frontier. By T. W. Balch. *With Maps.*

The writer describes in detail the Anglo-Russian negotiations in the early part of the nineteenth century leading up to the agreement of 1825, and reproduces various documents and maps. He holds that until the last few years the boundary claimed by the United States was universally accepted by English authorities.

Canada—British Columbia. *J.R. Colonial I.* **33** (1902): 204–225. **Turner.**

British Columbia of To-day. By Hon. J. H. Turner.

Canada—Labrador. **Daly.**

B. Museum Comparative Zoology Harvard College **38** (1902): 205–270.

The Geology of the North-East Coast of Labrador. By Reginald A. Daly. *With Maps and Plates.*

A note on this paper will be given.

Canada—Red River Valley. **Dowling.**

The Physical Geography of the Red River Valley. By D. B. Dowling. (Reprinted from the *Ottawa Naturalist*, vol. xv. No. 5, pp. 115–120, August, 1901.) Size 9 × 6. *Maps.*

Mexico. *B.S. d'Études Colon.* **9** (1902): 1–16. **Buttgenbach.**

Le nord-ouest du Mexique. Par H. Buttgenbach. *With Illustrations.*

Mexico. *National G. Mag.* **13** (1902): 1–24. **Foster.**

The New Mexico. By John W. Foster. *With Maps and Illustrations.*

Mexico. *J.G.* **1** (1902): 6–17. **Marshall.**

Useful Products of the Century Plant. A Lesson on Mexico. By William B. Marshall. *With Illustrations.*

On the species of *Agave* which produces "Sisal" hemp.

Mexico. *G.Z.* **7** (1901): 697–699. **Deckert.**

Die Territoral- und Bevölkerungsverhältnisse der mexikanischen Republik nach dem Census von 1900. Von Dr. E. Deckert.

Mexico—Lighthouses. ——

Estado de la Iluminacion y Avalizamiento en las Costas de los Estados Unidos Mexicanos en 31 de Diciembre de 1901. Mexico, 1902. Size 13½ × 9, pp. 30. *Charts and Illustrations. Presented by Mr. Henry A. Case.*

North and Central America. **Ridgway.**

B. United States Nat. Museum, No. 50 (1901): pp. xxx. and 716.

The Birds of North and Middle America. By Robert Ridgway. Part i. Family Fringillidæ—The Finches. *With Plates.*

North-west Coast. **Davidson.**

The Tracks and Landfalls of Bering and Chirikof on the North-west Coast of America from the point of their separation in lat. 49° 10′, long. 176° 40′ W., to their return to the same meridian. June, July, August, September, October, 1741. George Davidson (Private Publication), 1901. Size 10½ × 7, pp. 44. *Map.*

This is noticed elsewhere (p. 756, *ante*).

United States. *Deutsche Rundschau G.* **24** (1901): 123–127. **Blum.**

Die Entwickelung der Vereinigten Staaten von Amerika. Statistische Zusammenstellungen nach den Censusberichten der Regierung der Vereinigten Staaten, die Volkszählung von 1900 betreffend. Von Richard Blum.

United States. *J. Geology* **9** (1901): 718–731. **Salisbury.**

Glacial Work in the Western Mountains in 1901. By Rollin D. Salisbury.

United States. **Royce.**

Eighteenth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1896–97. By J. W. Powell, Director. In two parts. Part 2. Indian Land Cessions in the United States. Compiled by Charles C. Royce. Washington, 1899. Size 11½ × 8, pp. 521–997.

Contains a large amount of information bearing on the history of settlement in the United States. The bulk of the work is an enumeration of all the cessions of land by, or reservations for, Indian tribes from 1784 onwards, while the 67 maps show the extent of the individual cessions, etc.

United States—Arkansas. *J. Geology* **9** (1901): 694–701. **Purdue.**

Physiography of the Boston Mountains, Arkansas. By A. H. Purdue. *With Map and Section.*

United States—California. *Sierra Club B.* **4** (1902): 25–34. **Eells.**

In Tuolumne and Cathedral Cañons. By Alexander G. Eells. *With Plate.*

United States—Cascade Range. *Science* **15** (1902): 203–211. **Diller.**

The Wreck of Mt. Mazama. By J. S. Diller.

United States—Mississippi River. *J. School G.* **5** (1901): 379–382. **Davis.**

Maps of the Mississippi River. By Wm. Davis.

The author gives instances of the geographical facts illustrated by the maps of the "Mississippi River Commission," which are held to be the most valuable ever issued for a river of the first magnitude.

United States—Smithsonian Institution. **Rhees.**

Smithsonian Miscellaneous Collections. Vol. xliii. The Smithsonian Institution. Documents Relative to its Origin and History, 1835–1899. Compiled and edited by William Jones Rhees. In two volumes. Vol. ii. 1887–1899. Fiftieth Congress to Fifty-fifth Congress. Washington, 1901. Size 9½ × 6, pp. xvi. and 1045–1983. *Plans. Presented by the Smithsonian Institution.*

CENTRAL AND SOUTH AMERICA.

Bolivia—Cochabamba. **Blanco.**

Diccionario Geográfico de la República de Bolivia, Tomo Segundo, Departamento de Cochabamba. Por Federico Blanco, con adiciones de P. Aniceto Blanco y Manuel V. Ballivián. La Paz, 1901. Size 10½ × 7½, pp. xii. and 176. *Plan.*

Brazil. *Meteorolog. Z.* **19** (1902): 108–119. **Draenert.**

Das Klima von Juiz de Fora im Staate Minas-Geraes. Von Prof. F. M. Draenert.

Brazil—São Paulo. ——

Export **23** (1901): 635, 648–649, 663–665, 676–678; **24** (1902): 9.

Das Flussgebiet der Ribeira im Staate São Paulo. (Originalbericht aus São Paulo.)

Central America. **Sapper.**

Mittelamerikanische Reisen und Studien aus den Jahren 1888 bis 1900. Von Dr. Karl Sapper. Braunschweig: F. Vieweg & Son, 1902. Size 9½ × 6½, pp. xiv. and 426. *Maps and Illustrations. Price* 10*m*. *Presented by the Publishers.*

This will be reviewed elsewhere in the *Journal*.

Central America—Canal. *National G. Mag.* **13** (1902): 64–70. ——

The Latest Route proposed for the Isthmian Canal—Mandingo Route. *With Map and Profile.*

This route in question takes a straight course (without locks) of only 29½ miles between the Gulf of San Blas and the Bay of Panama, as compared with 499 miles by the Panama route, but involves a tunnel of 5 miles.

Chile. ——

Anuario hidrografico de la Marina de Chile. Tomo 23. Valparaiso, 1901. Size 10½ × 7, pp. 562. *Charts and Illustrations.*

The first section gives an account of various hydrographic surveys on the coasts of Chile, with some information on the fauna, flora, and geology.

Chile. *Scottish G. Mag.* **18** (1902): 14–24. **Gormaz.**

Depressions and Elevations of the Southern Archipelagoes of Chile. By Francisco Vidal Gomaz. *With Map.*

Chile and Argentina. *Scottish G. Mag.* **18** (1902): 87–90. **Gibson.**

The Boundary Dispute between Chile and Argentina. By Hope Gibson.

Guatemala. **Seler.**

Wissenschaftliche Ergebnisse einer . . . Reise durch Mexico und Guatemala. I. Die alten Ansiedelungen von Chaculá im Distrikte Nenton des Departements Huehuetenango der Republik Guatemala. Von Dr. Eduard Seler. Berlin: Dietrich Reimer (Ernst Vohsen), 1901. Size 13 × 10, pp. xviii. and 224. *Maps and Illustrations. Presented by the Publishers.*

This is the first part published of the archæological results of Prof. Seler's important researches in Central America, the popular account of which was reviewed in the *Journal* for February 1901. It is produced in first-rate style.

Guatemala. *M.G. Ges. Hamburg* **17** (1901): 78–224. **Sapper.**

Die Alta Verapaz (Guatemala). Eine landeskundliche Skizze. Von Dr. Karl Sapper. *With Maps.*

A detailed account of one of the most interesting districts of Guatemala, in which many Germans have started plantations of late years.

Guiana. *Rev. Colon.* **1** (1901): 160–185. **Guffroy.**

Note sur les peuples autochtones des Guyanes et sur les tribus noires du Maroni et de ses affluents, l'Awa et le Tapanahoni. Par M. Guffroy.

Jamaica. **Roxburgh and Ford.**

The Handbook of Jamaica for 1902, comprising Historical, Statistical, and General Information concerning the Island. Compiled by T. L. Roxburgh and Jos. C. Ford. London: E. Stanford, 1902. Size 8½ × 5½, pp. viii. and 524. *Map. Price 7s. 6d. Presented by the Publishers.*

Jamaica. *J.S. Arts* **50** (1902): 213–224. **Thomas.**

Jamaica. By Herbert T. Thomas.

Panama Canal. *Tour du Monde* **8** (1902): 1–12. **Bel.**

L'Isthme de Panama et le Canal Interocéanique. Par M. Raymond Bel. *With Map and Illustrations.*

Patagonia. *K. Svensk. Vetens.-A. Handlingar* **33** (1900): No. 3, pp. 24. **Nordenskiöld.**

Iakttagelser och fynd i grottor vid Ultima Esperanza i Sydvestra Patagonien. Af Erland Nordenskiöld. *With Plates.*

Peru. *B.S.G. Lima* **10** (1900–1901): 338–354; 423–441. **Clément**

Revisión del arco meridiano del Perú. Por el Coronel Pablo Clément. *With Diagram.*

Peru. *B.S.G. Lima* **10** (1900–1901): 243–312; 380–422; **11** (1901): 1–62. **Raimondi.**

Itinerario de los Viajes de Raimondi en el Peru. De Tayabamba á Carhuaz (1860). —Provincias de Huaylas, Huaraz, Huari y Huamalies (1860).—Pátapo, Pucalá, Chongoyape, Huando, Montán, Chota Hualgayoc, Cajamarca, Magdalena, San Pablo, San Miguel, Mina de Cushuro y pueblo de Niepos (1868).—De Niepos á Saña y regreso á Lambayeque (1868).

Peru and Bolivia. *B.S.G. Lima* **10** (1901): 445–482. **Polo.**

Indios Uros del Perú y Bolivia. Por José Toribio Polo. *Also separate copy, presented by the Author.*

Peru and Chile—Tacna. **Maurtua and Pezet.**

The Question of the Pacific. An Edition in English of the Work of Dr. Victor M. Maurtua. Enlarged and brought up to date, with Map of Disputed Territory, by F. A. Pezet. Philadelphia: G. F. Lasher, 1901. Size 9½ × 6½, pp. vi. and 312. *Map. Presented by Señor F. A. Pezet.*

Dr. Maurtua's work, lately published in Peru, has been extended by the translator with a view to presenting English readers, especially in the United States, with a comprehensive and accurate statement of the territorial question still in dispute between Chili and Peru. It goes back to the early political geography of the region in question, and traces the whole course of events which have led to the present difficulty. The clearly drawn map is on the scale of 1 : 750,000.

West Indies—Jamaica. **Rhodes.**

Jamaica and the Imperial Direct West India Mail Service. By Thomas Rhodes. London: S. Philip & Son. 1901. Size 6 × 10, pp. 44. *Map and Illustrations. Price 6d. net. Presented by the Publishers.*

The writer insists on the great natural resources of Jamaica, and urges the advantages of the island as the goal of a sea-trip.

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Aborigines. **Matthews.**

P.R.G.S. Australasia, South Australian Br. **4** (1901): 43–52.

Native Tribes of the Upper Murray. By Daniel Matthews.

Australia and Pacific. **Daiber.**

Eine Australien und Südseefahrt von Dr. Albert Daiber. Leipzig: B. S. Teubner, 1902. Size 9½ × 6½, pp. viii. and 320. *Map and Illustrations. Price 7s.*

An account of Australia for the benefit of German readers, who, the author thinks, possess very inadequate sources of information on many important questions relating to that country. Besides notes gathered by the author himself during his travels, it includes a more general discussion of the main physical, social, and economic features of Australia.

British New Guinea. **Le Hunte.**

British New Guinea. Report for 1899-1900. Colonial Reports, Annual No. 336, 1901. Size 9½ × 6, pp. 52. *Price* 3*d.*

Caroline Islands. *M.G. Ges. Hamburg* 17 (1901): 1-27. **Friederichsen.**

Die Karolinen. Von Dr. Max Friederichsen.

An excellent summary of our knowledge of the geography and natives of the Carolines.

Caroline and Marianne Islands. **Volkens.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 167-179.

Einige Ergebnisse einer Reise nach den Karolinen und Marianen. Von Prof. Dr. G. Volkens.

Attention is directed principally to the climate and vegetation of the islands, especially Yap.

Kerguelen Island. *Z. Ges. Erdk. Berlin* (1902): 64-65. **Schlüter.**

Ueber die Aussprache des namens Kerguelen. Von Dr. O. Schlüter.

The writer shows that the proper pronunciation of the name is Kergellen. The word is Breton, and means "House of the *Kelen*," or *Ilex aquifolia*.

New South Wales. **Coghlan.**

Picturesque New South Wales: an Illustrated Guide for Settler and Tourist. Prepared under the direction of T. A. Coghlan. Sydney, 1901. Size 10 × 7½, pp. iv. and 124. *Illustrations. Presented by the Agent-General for New South Wales.*

New South Wales. ———

Annual Report of the Department of Mines, New South Wales, for the year 1900. Sydney, 1901. Size 13 × 8½, pp. iv. and 218. *Plans and Illustrations.*

New South Wales. **Eyre.**

P.R.G.S. Australasia, South Australian Br. 4 (1901): 127-145.

Exploration in New South Wales in 1844. Letters from E. J. Eyre and enclosures thereto.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 467-471. **Best.**

Maori Origins. Part ii. By Elsdon Best.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 499-514. **Morris.**

On the Tracks of Captain Cook. By Prof. E. E. Morris.

Describes a visit to portions of the New Zealand coast first touched at by Cook.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 335-336. **Page.**

Notes on an Artesian-well system at the Base of the Port Hills. By S. Page, with Analyses by E. B. R. Prideaux.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 445-467. **Segar.**

The Population of New Zealand. By H. W. Segar.

New Zealand. *T. and P. New Zealand I.* 33 (1900): 313-323. **Thomson.**

Plant-acclimatisation in New Zealand. By George M. Thomson.

New Zealand—Year Book. **Dadelszen**

The New Zealand Official Year-Book, 1901. Prepared by E. J. von Dadelszen. Wellington: J. Mackay, 1901. Size 8½ × 5½, pp. vi. and 640. *Map, Diagrams, and Illustrations.*

Pacific. **Colquhoun.**

The Mastery of the Pacific. By Archibald R. Colquhoun. London: W. Heinemann, 1902. Size 10 × 6, pp. xvi. and 416. *Maps and Illustrations. Price* 18*s. net.*

Mr. Colquhoun, who has recently extended his previous wide acquaintance with the Far East by a tour in the Pacific, presents in this work an account of the conditions now prevailing in the spheres of the various powers in that ocean, which he regards as the scene of the great struggle of the twentieth century, where the future of more than one Great Power will be decided. It will prove valuable as directing attention to an important subject, and assisting the reader to forecast for himself the probable trend of future events. This map is incomplete as regards the Pacific steamship routes.

Queensland. **Cameron.**

Report on the Etheridge and Gilbert Gold Fields. By Walter E. Cameron, B.A. Brisbane, 1900. Size 13½ × 8½, pp. 16. *Maps and Sections.*

Queensland. **Cameron.**

Report on Recent Developments in the Copper-Mining Industry in the Cloncurry District. By Walter E. Cameron, B.A. Brisbane, 1900. Size 13½ × 8½, pp. 10. *Map and Plans.*

Queensland. *B. Geolog. Surv. Queensland*, No. 17 (1901): pp. 16. **Dunstan.**

Report on the Geological Features of Hazledean, west of Mackay: with Notes on the Coal, Limestone, and other Mineral Products of the Mackay District. By B. Dunstan. *With Map and Sections.*

Samoa, etc. **Hesse-Wartegg.**

Samoa, Bismarckarchipel und Neuguinea. Drei deutsche Kolonien in der Südsee. Von Ernst von Hesse-Wartegg. Leipzig: J. J. Weber, 1902. Size 10 × 7, pp. viii. and 330. *Maps and Illustrations. Price* 15*s.*

A well-illustrated popular account of a visit to the German South-sea colonies. The author has a good deal to tell of the inhabitants and general condition of those colonies, some of the places visited, *e.g.* the St. Matthias islands, being off the beaten track.

Solomon Islands. **Amherst and Thomson.**

The Discovery of the Solomon Islands by Alvaro de Mendaña in 1568. Translated from the original Spanish Manuscripts. Edited, with Introduction and Notes, by Lord Amherst of Hackney, and Basil Thomson. 2 vols. London: Printed for the Hakluyt Society, 1901. Size 9 × 6, pp. lxxxvi. and 482. *Maps and Plates. Presented by the Hakluyt Society. Also large paper copy, presented by the Authors.*

A collection of original authorities on Mendaña's voyage, including the MSS of Catoira, preserved in the British Museum, and of Gallego, now in the possession of Lord Amherst of Hackney, translations of both of which are published for the first time.

South Australia—Northern Territory. **[White.]**

Mission Field **46** (1901): 401–405; **47** (1902): 46–50.

The Diocese of Carpentaria. By the Bishop. *With Map and Illustrations.*

The Bishop of Carpentaria's Journey. *With Map.*

Western Australia. *Scottish G. Mag.* **18** (1902): 1–13. **Macdonald.**

Across the Westralian Desert. By Alexander Macdonald.

Western Australia. ——

The Land Selections' Guide to the Crown Lands of Western Australia. Perth, 1901. Size 8½ × 5½, pp. 66. *Maps and Illustrations. Presented by the Minister for Lands, W. Australia.*

Western Australia. ——

Western Australia and its Resources. Perth [*not dated*]. Size 8½ × 5½, pp. 136. *Maps and Illustrations.*

POLAR REGIONS.

Antarctic—Belgian Expedition. **Gerlache.**

Voyage de la *Belgica*. Quinze Mois dans l'Antarctique. Par le Commandant de Gerlache. Preface par Élisée Reclus. Deuxième Édition. Paris: Hachette & Cie., 1902. Size 10 × 6½, pp. vi. and 292. *Map and Illustrations. Presented by the Publishers.*

An extension of the series of articles which appeared last year in the *Tour du Monde*. A notice will be given elsewhere.

Antarctic—German Expedition. *Petermanns M.* **48** (1902): 40–44. **Drygalski.**

Die deutsche Südpolar-Expedition. Zweiter Bericht von Prof. Dr. E. v. Drygalski.

Antarctic—Meteorology. **Arctowski.**

Expédition Antarctique Belge. Résultats du Voyage du S.Y. Belgica en 1897–1898–1899 sous le Commandement de A. de Gerlache de Gomery. Rapports scientifiques. Météorologie, Aurores australes. Par Henryk Arctowski Anvers:

Imp. J.-E. Buschmann, 1901. Size 13½ × 11, pp. 64. *Illustrations. Presented by the Author.*

The scientific results of the voyage of the *Belgica* will be reviewed on the completion of publication.

Arctic. **Abruzzi.**

Farther North than Nansen; being the Voyage of the *Polar Star*. By H.R.H. The Duke of the Abruzzi. London: H. W. Bell, 1901. Size 10½ × 6½, pp. 98. *Illustrations. Presented by the Publishers.*

Translation of the addresses delivered by the Duke of the Abruzzi and Commander Cagni, before the Italian Geographical Society, and published in the *Bolletino* for February, 1901.

Arctic. **Amundsen.**

Kaptein Roald Amundsen: En paatoenkt Undersøgelsesreise til den magnetiske Nordpol. Foredrag den 25 de November, 1901. Size 9½ × 6½, pp. 12. *Map.*

A translation of this paper was given in the April *Journal* (p. 484).

Arctic—Phytogeography. *G.Z.* **8** (1902): 1–23. **Andersson.**

Zur Pflanzengeographie der Arktis. Von Dr. Gunnar Andersson. *With Maps and Illustrations.*

Arctic—Pilot. **Maclear.**

Arctic Pilot. Vol. ii. Sailing directions for Færoe Islands, Iceland, Greenland Sea, Spitzbergen, and the East Coast of Greenland. Compiled by Vice-Admiral J. P. Maclear. London: J. D. Potter, 1901. Size 9½ × 6, pp. xxii. and 264. *Index Map. Price 4s. Presented by the Hydrographer, Admiralty.*

Compiled from the accounts of all the chief arctic navigators. The first chapter includes, in addition to information on the climate, ice, currents, etc., of the Arctic ocean, a geographical and general description of the arctic lands from the Færoes to East Greenland.

Arctic—Wellman Expedition. *M.K.K.G. Ges. Wien* **44** (1901): 177–184. **Brosch.**

Die Wellman'sche Polar-Expedition 1898–99, nach dem Kaiser-Franz-Josefs-Land. Von K. u. K. Contre-Admiral Gustav Ritter v. Brosch. *With Maps.*

Greenland. *Verh. Ges. Erdk. Berlin* **28** (1901): 475–481. **Amdrup.**

Herr Oberleutnant zur See Amdrup: Die Dänischen Expeditionen nach Ost-Grönland in den Jahren 1898–1899 und 1900. *With Map.*

Greenland. *Verh. Ges. Erdk. Berlin* **28** (1901): 482–485. **Hartz.**

Herr Dr. N. Hartz: Die Schiffsreise der Dänischen Expedition nach Ost-Grönland im Jahr 1900.

Ice Navigation. *Mem. Hydrography* **23** (1901): 192–217. **Islyamoff.**

Experimental Trip of "Yermak" in 1899. By I. Islyamoff. [In Russian.] *With Illustrations.*

Polar Regions—Magnetism. **Neumayer.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 54–59.

Die Ergebnisse neuerer erdmagnetischer Beobachtungen in den Polar-Regionen. Von Prof. Dr. G. v. Neumayer.

MATHEMATICAL GEOGRAPHY.

Astronomy. **Penrose.**

On a method of predicting by Graphical Construction Occultations of Stars by the Moon and Solar Eclipses for any given place; together with more rigorous methods of reduction for the accurate calculation of longitude. By Francis Cranmer Penrose. Second Edition. London: Macmillan & Co., 1902. Size 15½ × 10, pp. x. and 42. *Diagrams. Price 12s. net. Presented by the Author.*

Determination of Positions. *Z. Ges. Erdk. Berlin* **36** (1901): 255–276. **Marcuse.**

Die neuere Entwickelung der geographischen Ortsbestimmung. Von Privatdocent Dr. Adolf Marcuse. *With Plate.*

Geodesy. *Rev. Scientifique* **17** (1902): 161–169. **Laussedat.**

Les progrès de la géodésie. Par A. Laussedat. *With Illustration.*

Geodesy. **Orff.**

Ueber die Hülfsmittel, Methoden und Resultate der Internationalen Erdmessung.

Festrede gehalten in der öffentlichen Sitzung der k. b. Akademie der Wissenschaften zu München am 15 November, 1899. Von Dr. phil. Karl v. Orff. München, 1899. Size 11 × 8½, pp. 60. *Presented by the Academy.*

Latitudes and Longitudes. ———

Accessions (No. VI.) to Collection of Latitudes and Longitudes. Map Room, Intelligence Division, W.O., December, 1901. Size 12½ × 10, pp. iv. and 54.

With the exception of six in China and one in British Guiana, all these positions refer to Africa.

Longitude Determination. *C. Rd.* **134** (1902): 387–389. **Lippmann.**

Appareil pour mesurer les différences de longitude à l'aide de la photographie. Note de M. G. Lippmann.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Dust-rain. *Abh. K. Preuss. Meteorolog. I.* **2** (1901): 1-93. **Hellmann and Meinardus.**

Der grosse Staubfall vom 9. bis 12. März, 1901, in Nordafrika, Süd- und Mitteleuropa. Von G. Hellmann und W. Meinardus. *With Maps.*

The fall has been found to have extended from Southern Algeria to Southern Denmark, over a land area of 300,000 square miles. This was not continuous, but was broken by tracts in which no fall was observed.

Geophysics. *XXVII. Jahresb. V. Erdk. Dresden* (1901): 105–124. **Reibisch.**

Ein Gestaltungsprincips der Erde. Von Paul Reibisch.

The author discusses the effects of a differential movement of the surface with respect to the poles on the elevation and depression of different parts of the surface.

Glaciers. **Finsterwalder.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 180–182.

Die Erscheinungen, welche einem Gletschervorstoss vorausgehen. Von Prof. Dr. S. Finsterwalder.

Glaciers. *Verh. Dreizehnten Deutsch. Geographentages Breslau* (1901): 183–187. **Meyer.**

Ein Beitrag zur Gletscherkunde der Tropen. Von Prof. Dr. Hans Meyer.

Ice. *P.R.S.* **69** (1902): 429–424. **Vincent.**

The Density and Coefficient of Cubical Expansion of Ice. By J. H. Vincent, D.SC. (Abstract.)

Land-areas. *G.Z.* **7** (1901): 665–676. **Simroth.**

Ueber das Problem früheren Landzusammenhangs auf der südlichen Erdhälfte. Von Dr. H. Simroth. *With Map.*

Limnology. **Halbfass.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 248–261.

Die wissenschaftliche und wirtschaftliche Bedeutung limnologischer Landesanstalten. Von Dr. W. Halbfass. *Also separate copy, presented by the Author.*

Meteorology. *Monthly Weather Rev.* **29** (1901): 408–418. **Kimball.**

The General Circulation of the Atmosphere, especially in Arctic Regions. By H. H. Kimball.

Meteorology. *Monthly Weather Rev.* **29** (1901): 545–546. **Balch.**

Evaporation Underground. By E. S. Balch.

The writer holds that we have yet absolutely no proof that subterranean ice (cf. *Journal*, vol. xix. p. 220) is ever produced by evaporation.

Meteorology—Auroras. *C. Rd.* **134** (1902): 93–95. **Stassano.**

De l'influence des basses pressions barométriques sur la fréquence des aurores polaires. Note de M. H. Stassano.

Mirage. *Ann. Hydrographiques* **2** S. (1901): 34–35. **Hervé.**

Note sur des observations de mirage faites à bord du croiseur *Chasseloup-Laubat*, le 27 mai 1901. Par M. Hervé. *With Illustrations.*

Mountains. *Scottish G. Mag.* **18** (1902): 76–84. **Geikie.**

Mountains. By Prof. James Geikie, F.R.S. II. *With Diagrams.*

Nautical Almanac. ———

The Nautical Almanac and Astronomical Ephemeris for the year 1905, for the meridian of the Royal Observatory at Greenwich. Edinburgh (not dated). Size 9 × 6, pp. 652 and 18. *Diagrams. Price 2s. 6d. Presented by the Admiralty.*

Part I. is also issued separately, *price* 1*s.*

Ocean Currents. **Russell.**

Current Papers, No. 5. By H. C. Russell, B.A., C.M.G., etc. (Read before the Royal Society of N. S. Wales, November 7, 1900.) Size 9 × 5½, pp. 12. *Diagrams.*

Oceanography. *M.K.K.G. Ges. Wien* **44** (1901): 189–195. **Fuchs.**

J. Luksch's Untersuchungen über die Transparenz und Farbe des Meerwassers. Von Prof. Theodor Fuchs.

Oceanography. *Ciel et Terre* **22** (1901): 481–492. **Thoulet.**

La transparence et la couleur de la mer. Par J. Thoulet.

Oceanography. *C. Rd.* **134** (1902): 496–498. **Thoulet.**

Sur la constitution du sol subocéanique. Note de M. J. Thoulet.

Oceanography. *A travers le Monde, Tour du Monde* **8** (1902): 53–55. ———

Les plus grandes profondeurs de la Mer.

Oceanography—Fauna. *M.K.K.G. Ges. Wien* **44** (1901): 185–188. **Fuchs.**

Ueber das im Gefolge heftiger Stürme beobachtete Auftreten pelagischer Tiefseethiere an der Oberfläche des Meeres. Von Theodor Fuchs.

Oceanography—North Atlantic. **Peake and Murray.**

On the Results of a Deep-sea Sounding Expedition in the North Atlantic during the Summer of 1899. By R. E. Peake. With Notes on the Temperature Observations and Depths, and a Description of the Deep-sea Deposits in this Area. By Sir John Murray, K.C.B., etc. London: John Murray, 1901. Size 9½ × 6½, pp. 44. *Charts. Price* (to Fellows) *2s. 6d. net;* (to non-Fellows) *5s. net.*

One of the extra publications of the R.G.S. The soundings were taken by the *Britannia*, (1) in the vicinity of the Azores; (2) between the Azores and North America; (3) between the Azores and the British Isles. The large map shows the distribution of marine deposits, embodying the results obtained by the *Britannia*.

Oceanography—Plankton. **Cleve.**

K. Svensk. Vetens.-A. Handlingar **34** (1901): Nos. 1–3, pp. 22, 77, 22.

Notes on some Atlantic Plankton-organisms. By P. T. Cleve. *With Plates.*

The Plankton of the North Sea, the English Channel, and the Skagerack in 1899. By the same.

Report on the Plankton collected by the Swedish Expedition to Greenland in 1899. By the same.

Underground Waters. *C. Rd.* **134** (1902): 129–132. **Fournier.**

Sur la structure des réseaux hydrographiques souterrains dans les régions calcaires. Note de M. E. Fournier. *With Sketch-map.*

Zoogeography. *Naturw. Wochenschrift* **1** (1901): 97–100, 117–118. **Martens**

Ueber die Abgrenzung Zoogeographischer Reiche. Von Prof. E. v. Martens.

Zoogeography. *C. Rd.* **134** (1902): 115–117. **Vaney and Conte.**

Sur la distribution géographique et l'adaptation aux eaux douces de quelques formes marines. Note de MM. C. Vaney et A. Conte.

Zoogeography—Mosquitoes. **Theobald.**

A Monograph of the Culicidæ, or Mosquitoes, mainly compiled from the Collections received at the British Museum from various parts of the world, in connection with the investigation into the cause of Malaria, conducted by the Colonial Office and the Royal Society. By Fred V. Theobald. Two vols. and *Plates.* London: 1901. Size 8½ × 5½, pp. (vol. i.) xviii. and 424, (vol. ii.) viii. and 392. *Presented by the Trustees of the British Museum.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Agriculture. *Z. Ges. Erdk. Berlin* **36** (1901): 230–254. **Hahn.**

Ursprungsgebiet und Entstehungsweise des Ackerbaues. Von Dr. Eduard Hahn.

Anthropogeography. *Ann. G.* **11** (1902): 13–23. **De la Blache.**

Les conditions géographiques des faits sociaux. Par P. Vidal de la Blache.

Anthropogeography. *Popular Sci. Monthly* **60** (1902): 336–345. **Mason.**

Environment in Relation to Sex in Human Culture. By Prof. Otis T. Mason.

An examination of the culture-areas of the world in regard to the status in them of men and women.

Anthropogeography. *G.Z.* **8** (1902): 92–100. **Hettner**

Die wirtschaftlichen Typen der Ansiedelungen. Von Alfred Hettner.

Ethnology. **Schurtz.**

Alterklassen und Männerbünde. Eine Darstellung der Grundformen der Gesellschaft. Von Heinrich Schurtz. Berlin: G. Reimer, 1902. Size 9 × 6, pp. x. and 458. *Map. Price 8s.*

On certain special forms of social organization among primitive peoples, especially the system of separate quarters for men, sometimes known as "communal barracks." The distribution of this system throughout the world is very fully dealt with.

Historical. *Riv. G. Italiana* **9** (1902): 3–38. **Uzielli.**

Toscanelli, Colombo e la leggenda del Pilota. Memoria del Prof. Gustavo Uzielli.

A criticism of M. Vignaud's work (cf. review, *ante*, p. 749).

Historical Geography. **Wagner.**

Vignaud, Henry. La lettre et le carte de Toscanelli sur la route des Indes, etc. (Von Hermann Wagner.) Sonder-Abdruck aus den Göttingischen Gelehrten-Anzeigen unter der Aufsicht der Königl. Gesellschaft der Wissenschaften, 1902. No. 2. Size 9½ × 6½, pp. [14]. *Presented by the Author.*

Criticism of M. Vignaud's work (cf. *ante*, p. 749).

Slavery. *Petermanns M.* **47** (1901): 285–287. **Vierkandt.**

Die Sklaverei als ein Wirtschaftssystem. Von Dr. A. Vierkandt.

BIOGRAPHY.

Cordeiro. *B.S.G. Lisboa* **18** (1900): 667–685. **Amaral and Pedroso.**

A Luciano Cordeiro, discurso do Conselheiro F. J. Ferreira do Amaral.—Luciano Cordeiro e a sua obra. Por Z. Consiglieri Pedroso.

Nubkissen. **Ghose.**

Memoirs of Maharaja Nubkissen Bahadur. By N. N. Ghose. Calcutta: K. B. Basu, 1901. Size 10 × 6½, pp. vii. and 242. *Portraits and Illustrations. Price 7s. 6d. Presented by the Author.*

Nubkissen was one of the characters who came upon the scene in the stormy days of Warren Hastings' administration. The author considers that in character and aspirations he was the very antithesis of Nuncomar, as to whom he accepts the verdict of Sir James Stephen.

Orléans. *Deutsche Rundschau G.* **24** (1901): 136–138. ——

Prinz Henri d'Orléans. *With Portrait.*

Rhodes. **Hensman.**

Cecil Rhodes. A Study of a Career. By Howard Hensman. Edinburgh: W. Blackwood & Sons, 1901. Size 9 × 6, pp. xiv. and 382. *Portraits and Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

Tomaschek. *Vierteljahrshefte G. Unterricht* **1** (1902): 102–112. **Sieger.**

Wilhelm Tomaschek. Von Dr. R. Sieger. *With Portrait.*

GENERAL.

British Association. ——

Report of the Seventy-first Meeting of the British Association for the Advancement of Science, held at Glasgow, in September, 1901. London: John Murray, 1901. Size 9 × 5½, pp. cxx., 900, and 114. *Diagrams. Presented by the British Association.*

Colonies. **Austin**

Colonial Administration, 1800–1900. Methods of Government and Development adopted by the principal Colonizing Nations in their control of Tropical and other Colonies and Dependencies. With statistical statements of the Area, Population, Commerce, Revenue, etc., of each of the World's Colonies. Including Bibliography of Colonies and Colonization prepared by the Library of Congress. (From the Summary of Commerce and Finance for October, 1901.) O. P. Austin, Chief of Bureau (Treasury Department—Bureau of Statistics). Washington, 1901. Size 11½ × 9½, pp. 1199–1631. *Maps. Presented by the Philadelphia Commercial Museums.*

Colonies. **Zimmermann.**

Le Problème Colonial au début du XX^e^ siècle. Leçon d'ouverture faite à la Faculté des Lettres le 5 décembre, 1901. Par M. Maurice Zimmermann. Lyon: A. Storck & Cie., 1902. Size 10 × 6½, pp. 24.

Discusses the tasks to be performed and some of the difficulties to be overcome in European Colonial undertakings.

Eastern Lands. **Hogarth.**

The Nearer East. By D. G. Hogarth. London: W. Heinemann, 1902. Size 9½ × 6, pp. xvi. and 296. *Maps and Diagrams. Price 7s. 6d. Presented by the Publishers.*

This will be reviewed in an early number of the *Journal*.

Education. **Kirchhoff.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 111–115.

Die Verknüpfung der physischen mit der politischen Landeskunde im Schulunterricht. Von Prof. Dr. A. Kirchhoff.

Education. **Langenbeck.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 116–123.

Die Verknüpfung der physischen mit der politischen Landeskunde in Schulunterricht. Von Prof. Dr. Langenbeck.

Education. **Wagner.**

Verh. Dreizehnten Deutsch. Geographentages Breslau (1901): 60–74.

Die Organisation des geographischen Unterrichts nach den neuen Lehrplänen. Von Prof. Dr. Hermann Wagner.

Educational. *National G. Mag.* **13** (1902): 55–64. **Tarr.**

The Teaching of Geography. By Ralph S. Tarr.

Engineering Congress.

International Engineering Congress. Glasgow, 1901. Meeting held at the University, Glasgow, on the 3rd, 4th, and 5th September, 1901. 2 vols. Vol. I. Proceedings of Section I.—Railways. Vol. II. Proceedings of Section II.—Waterways and Maritime Works. London: W. Clowes & Sons, 1902. Size 10 × 6½, pp. (vol. i. 84) (vol. ii. viii. and 214). *Maps, Diagrams, and Illustrations. Price*, vol. i. 5*s.* 6*d.*, vol. ii. 6*s.* 6*d. Presented by the Executive Committee of the Congress.*

Exploration. *B.S.G. Lyon* **17** (1902): 511–544. **Groffier.**

Explorations et Travaux Géographiques des Missionnaires Catholiques en 1900. Par M. Valérien Groffier.

French Colonies. **Dubois and Terrier.**

Les Colonies Françaises. Un Siècle d'expansion Coloniale. Par Marcel Dubois et Auguste Terrier. (Exposition Universelle de 1900.) Paris: A. Challamel, 1902. Size 9 × 6, pp. 1072.

This ranks as vol. i. of the series of publications issued in connection with the International Exhibition of 1900, other volumes of which were noticed in the *Journal* a year ago. It is written in a scholarly way, taking account of the broad principles which have operated in the course of French colonial history, of which it supplies perhaps the clearest general outline that has yet appeared.

German Colonies.

Jahresbericht über die Entwickelung der deutschen Schutzgebiete in Afrika und der Südsee im Jahre 1900-1901. Mit einem Bande Anlagen. (Beilage zum Deutschen Kolonialblatt, 1902.) Berlin: E. S. Mittler, 1902. Size 12 × 9, pp. 112, 352.

Hindustani Language. **Thimm.**

Hindūstānī Self-taught with English Phonetic Pronunciation. Containing Vocabularies—Idiomatic Phrases and Dialogues—Travel Talk—Military, Legal, Religious, Commercial, Shooting, and Fishing Terms—Money, Weights and Measures—Indian Titles, Castes, Festivals. By C. A. Thimm. London: E. Marlborough & Co., 1902. Size 7 × 4½, pp. 112. *Price* 2*s.* 6*d. Presented by the Publishers.*

Although no doubt of much use for self-tuition in Hindustani, this little work is incomplete for that purpose without the companion volume, "Hindustani grammar self-taught" being in the main a collection of vocabularies and phrases. The phonetic

system is not always satisfactory: thus *u* is used both for the indefinite *a* sound in *amount* (for which it seems particularly unsuitable when occurring at the end of a word), and for the *u* sound in *pull*; while *i* serves both for the diphthong *ai* and for the short *i*, as in *fit*. The occasional use of paraphrases without a statement of the literal meaning is also a defect.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles. **Ordnance Survey.**

Ordnance Survey revised map on the scale of 4 miles to an inch. England and Wales. Sheets 1, 2, 3, and 4. *Price* 1*s.* 6*d. each sheet.* Scotland. Sheets 1, 2, 3, 4, 5, and 6. *Price* 1*s. each sheet.* Ordnance Survey Office, Southampton. *Presented by the Director-General, Ordnance Survey.*

These maps serve well to exemplify the very successful attempts that have been made during recent years to render the sheets of the Ordnance Survey of more general and popular service, and to print them in colours by which due prominence can be given to the physical features, roads, etc., without obscuring the lettering. The Director-General may be congratulated upon the results he has obtained, after the painstaking attention he has given to the matter, and these two maps of England and Wales and Scotland, on the scale of 4 miles to an inch, will no doubt meet with a ready welcome. They are similar in style of production and are reduced from the revised 1-inch maps. Five colours are employed—water blue, hills brown, woods green, main roads burnt sienna, and outline and lettering black, which combination gives a very clear and artistic result. The hill shading is shown in a manner which has not before been attempted by the Ordnance Survey—in stipple by photo-etching. No contour lines are given, but numerous altitudes are indicated in figures. One good feature of the maps, which will certainly be appreciated by cyclists, is the manner in which the roads are distinguished. First-class roads are shown by a double line and coloured, second-class roads by a double line uncoloured, and third-class roads by a single black line. There is a footnote stating that the representation of a road upon the maps is no evidence of the existence of a right of way. The map of England and Wales will consist altogether of twenty-four sheets, of which Nos. 1, 2, 3, and 4, including Northumberland, Durham, Cumberland, the northern parts of Westmoreland, Yorkshire, and the Isle of Man, are now published, whilst the map of Scotland will comprise seventeen sheets, of which Nos. 1 to 6 are on sale. These include the Shetland and Orkney Islands, Sutherland, Caithness, the northern part of Rosshire, the island of Lewis, and neighbouring islands.

A black and white 4-miles-to-the-inch map of England and Wales has already been completed, and a similar map of Scotland is in course of preparation, but these are without hill-work. The 4-miles-to-the-inch scale was first decided upon for military purposes, but it was afterwards considered that this scale would be useful for other purposes, as it admits of showing railways, important roads, and general topographical features with considerable amount of detail.

Channel Islands.

Jersey. Scale 1 : 31,680 or 2 inches to 1 stat. mile. *Price* 1*s.*

(*E. Stanford, London Agent.*)

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Revised sheets published by the Director-General of the Ordnance Survey, Southampton, from April 1 to 30, 1902.

1 inch:—

With hills in brown or black: 85, 168, 178, 179 (engraved). 1*s. each.*

6 inch—County Maps:—

Bedfordshire, 2 S.W., 10 N.E., 11 N.E., S.E., 24 N.W., 31 N.W. **Derbyshire,** 60 N.W., N.E., S.W. **Huntingdonshire,** 5 S.W., 16 S.W., 20 S.E., 21 N.W., N.E., 25 N.E. **Monmouthshire,** 1 S.W. (2 S.E. and 4 N.E.), 3 N.E., S.W., S.E. (4 N.E. and 2 S.E.), 5 (N.W. and S.W.), 7 N.W., S.W., S.E., 8 N.W., 11 S.W., S.E., 12 N.E., S.W., 13 N.W., S.W., 14 N.W., S.E., 19 N.E., S.E., 20 N.W., S.W., 22 N.E., 23 S.E., 24 N.W., S.W., 25 N.E., S.W., 27 N.E., 29 N.W., S.E., 30 N.E., 33 S.E., 34 N.E., 40 N.W. **Staffordshire,** 47A N.W. **Wiltshire,** 63 S.W., 64 S.W., 66 S.E., 68 N.E., 74 N.E., 77 S.E. 1*s. each.*

25-inch—County Maps:—

Cambridgeshire, III. 4; IV. 5, 6, 7, 10, 11; XVI. 1, 4, 8, 12; XXI. 4, 9, 10, 11, 14; XXV. 5; XXXIII. 9, 13; XXXVIII. 3, 7, 11, 14, 15; XLV. 3, 9, 10, 11. **Dorsetshire,** VII. 1, 5, 6; XXXII. 11, 15; XLI. 3, 7; XLII. 1, 2, 5, 6, 9, 10, 13, 14, 15; XLIII. 16; XLIV. 6, 7, 10, 11, 14, 15; XLIX. 3, 4, 7, 8, 11, 12, 16; LV. 4, 7, 8, 11, 12, 16. **Gloucestershire,** V. 9, 13, 14; VII. 16; XIII. 5; XIV. 9, 10, 14; XV. 5, 9, 14; XX. 1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 15; XXI. 1, 5, 11, 13, 14, 16; XXII. 2, 5, 9, 10, 11, 13, 15; XXVIII. 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16; XXIX. 1, 2, 5; XXXII. 9, 10, 11, 14; XXXV. 5; XLI. 11; XLIX. 5, 6, 11, 12; LVIII. 1. **Huntingdonshire,** XXIII. 9, 13; XXVI. 3, 7, 11, 14, 15; XXVIII. 3, 9, 10, 11. **Montgomeryshire,** XVI. 15; XXII. 8, 10, 11, 12, 13, 15, 16; XXIII. 4, 6; XXIX. 2, 4; XXXIV. 15; XXXV. 5, 6, 7, 9, 10, 12; XLI. 1. **Shropshire,** XV. 13; XXIII. 12; XXIV. 9, 13; XXVIII. 13, 14, 15; XXIX. 13; XXXI. 13; XXXII. 15; XXXIII. 4; XXXV. 5, 8; XXXVI. 2. **Somerset,** LXXXV. 1, 5, 6. **Staffordshire,** XLIII. 4, 7, 8, 12, 15, 16; XLIV. 1, 2, 5, 6, 9, 10, 11, 13, 14, 15, 16; XLV. 8, 10, 12, 14, 15; XLVI. 4, 5, 13; LII. 3. **Worcestershire and Do.** (**Det.** 4, 5, and 6); XLVIII. 10 (Area of Bredon's Norton Parish only), 11 (Areas of Bredon and Bredon's Norton Parishes only), 14 (Areas of Bredon and Bredon's Norton Parishes only); LVI. 5; LVII. 10, 14; LVIII. 5, 9; LXI. 1; LXII. 11. **Yorkshire,** CCXCIX. 12; CCC. 1, 2, 3, 4, 5, 6, 8, 9, 11, 13, 14. *3s. each.*

England and Wales. **Bartholomew.**

Cyclists' Road Map of the Leeds, Bradford, and York District. Reduced from the new revised Ordnance Survey. Scale 126,720 or 2 stat. miles to an inch. Edinburgh: J. Bartholomew & Co., 1902. *Price* 1*s.* 6*d.*, *mounted on cloth. Presented by the Publishers.*

Unlike most of Bartholomew's reduced Ordnance maps, no orographical colouring is employed upon the present sheet, which is to be regretted, although of course the omission considerably reduces the cost of production, and consequently the price. However, the elevations and depressions are indicated by contour-lines and figures, and roads suitable for cycling coloured brown, a distinction being made between first and second class cycling roads. This sheet extends from Ripon on the north, to Sheffield on the south, and from Altrincham on the west, to a few miles to the east of Market Weighton on the east, and thus includes, amongst other important centres, York, Harrogate, Bradford, Leeds, Manchester, Wakefield, and Gainsborough.

Tyrol. **Burgklehner.**

Mathias Burgklehners Tirolische Landtafeln 1608, 1611, 1620. Abdruck der in den Kunsthistorischen Sammlungen des Allerhöchsten Kaiserhauses in Wien aufbewahrten Holzstöcke und Kupferplatten. Herausgegeben mit Genehmigung des Oberstkammereramtes seiner Kaiserlichen und Königlichen Apostolischen Majestät. Mit einem Begleittexte von Eduard Richter. Wein: Adolf Holzhausen. *Presented by Dr. Eduard Richter.*

The author of these maps, Mathias Burgklehner, who lived from 1573 to 1642, was not a cartographer by profession, but a lawyer and an official. He wrote a history of Tyrol in twelve volumes, which remained in manuscript, for the illustration of which the map, executed A.D. 1611, was probably intended. It is uncertain whether Burgklehner constructed the map himself, or had it made for him. The blocks on which it was engraved, preserved in the Hof Museum at Vienna, have lately been reproduced by Messrs. Holzhausen in a large folio. The map of the Tyrol on twelve sheets, placed together, makes a wall map over 4 feet square. The towns, woods, villages, and mountains are drawn in rough perspective in a bold and highly picturesque style. Very few names of peaks are given, but the passes, or "Thaüren," of Central Tyrol are marked, and the name "Gloggner" may be discovered. Here and there the plate is enlivened by a representation of a battle, or some stags! It is further adorned with numerous coats-of-arms of cities, heraldic devices, and a fine Renaissance border. The surrounding countries are covered with clouds. Dr. Eduard Richter gives an interesting sketch of Burgklehner's life and work in the accompanying text.

ASIA.

Asia. **Heiderich.**

Hölzel's Schulwandkarte von Asien. II. Auflage. Vollkommen neubearbeitet von Dr. Franz Heiderich. Scale 1 : 8,000,000 or 126·2 stat. miles to an inch. Wien: Ed. Hölzel. 6 sheets. *Price* 13*s.* 6*d.*

This is the second and revised edition of a school wall map of Asia, measuring

about 4½ feet by 6½ feet when the sheets, which are six in number, are joined as one. Heights above sea-level are shown by a combination of hachuring and six shades of colour-tinting at intervals varying from 200 to 2500 metres, whilst another shade indicates depressions. The depths of the sea are shown in the usual manner by five tints of blue, which increase in density with the depths. There is hardly sufficient difference between some of the shades of colour used to give satisfactory results, and it would have been better if, instead of employing different colours to indicate the altitudes, shades of one colour only had been selected, as is the case with Mr. Mackinder's geographical map of Europe. The hill shading beneath the colour tinting is somewhat misleading in its general effect, as it necessarily darkens some of the tints, and thus gives the impression that the altitude is greater than it really is.

Asia Minor. **Kiepert.**

Karte von Kleinasien. Scale 1 : 400,000 or 6·3 stat. miles to an inch. Von Dr. Richard Kiepert. Sheets: C IV. Kaisarie; D III. Ermenek. Berlin: Dietrich Reimer (Ernst Vohsen), 1902. *Price 6 marks each sheet.*

With the present issue there are altogether five sheets of Dr. Kiepert's new map of Asia Minor now published; these are—A IV. Sinob; B IV. Jozgad; C III. Konia; C IV. Kaisarie; and D III. Ermenek. The map when complete will comprise altogether twenty-four sheets. The two sheets just published are in every respect equal to the earlier ones, and it is evident that the author has made good use of the best available information, that obtained from Turkish and Greek sources being specially distinguished. A notice of this most important map was given in the February number of the *Geographical Journal* for this year.

Hong-Kong. **Public Works Department, Hong-Kong.**

Plan of the City of Victoria, Hong-Kong, 1901. Scale 160 feet to an inch. 10 sheets. *Presented by H.M. Secretary of State for the Colonies.*

Siberia. **Petermanns Geographische Mitteilungen.**

Sibirikows Weg von Jakutsk zum Ochotskischen Meere. Scale 1 : 7,500,000 or 118·3 stat. miles to an inch. Der Weg von Ajan nach Neljkan. Scale 1 : 2,000,000 or 31·5 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 8. Gotha: Justus Perthes. *Presented by the Publisher.*

Singapore. **Van Cuylenburg.**

Map of the Island of Singapore and its Dependencies, 1898. Scale 1 : 63,360 or 1 stat. mile to an inch. Prepared and drawn by John Van Cuylenburg, Surveyor-General's Office, Singapore. *Price 16s.*

This is a useful general map of the island of Singapore, printed in colours. It shows by different symbols boundaries of districts and estates, main roads, minor roads, cart-tracks and footpaths, proposed roads, proposed railway, forest reserves, and trigonometrical stations. It also indicates the police stations, Government vernacular schools and bungalows. Altitudes are given in feet. Although useful for the information the map contains, its execution leaves much to be desired, and in many places the names and figures are very indistinct.

Tonkin. **Friquegnon.**

Tonkin et Haut Laos par le Commandant Friquegnon de l'Infanterie de Marine. Carte dressée d'après les travaux des Officiers des troupes de l'Indo-Chine, du Service Hydrographique de la Marine, des membres de la mission Pavie, du Prince H. d'Orléans et du Lieut. de Vaisseau. Roux, 1902. Scale 1 : 500,000 or 7·8 stat. miles to an inch. Service Géographique des Colonies. Camile Guy, Chef de Service. Paris: Augustin Challamel. 4 sheets. *Price 12s.*

In addition to Tongking, this map includes the northern portions of Siam and Annam and parts of southern China, extending approximately from 17° 45′ to 23° 20′ N. lat., and from 100° to 108° 10′ E. long. With the exception of Tongking itself and the coast territories of Annam, the region included is very imperfectly known, and a good deal that is laid down on the map must not be relied on with any certainty. Like many of the French Government maps, it is well executed and most artistically printed in colours. There is an inset on a larger scale (1 : 300,000) of the delta of Tongking from Hanoi to the coast.

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Sheet: (Provisional) 78–H, Boma. London: Intelligence Division, War Office, 1902. *Price 1s. 6d.* Stanford. *Presented by the Director-General of Mobilization and Military Intelligence.*

West Africa. **Langhans.**

Langhans: Beiträge zur Kenntnis der deutschen Schutzgebiete, No. 18: Reisewege des Presbyterianer-Missionars Alexander Ross von Alt-Kalabar ins Kamerun Gebiet 1877 und 1878. Von Paul Langhans. Scale 1:200,000 or 3·1 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902. Tafel 7. Gotha: Justus Perthes. *Presented by the Publisher.*

NORTH AMERICA.

Bering Strait. **Immanuel.**

Die Goldgebiete zu beiden Seiten der Beringstrasse. Von Hauptmann H. Immanuel. Karte der Tschuktschen Halbinsel. Scale 1:3,000,000 or 47·3 stat. miles to an inch. Karte der Seward Halbinsel. Scale 1:2,000,000 or 31·5 stat. miles to an inch. Die Verkehrswege nach den Klondike Goldfeldern. Scale 1:20,000,000 or 315·6 stat. miles to an inch. Die Goldfelder von Klondike. Scale 1: 10,000,000 or 157·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1902, Tafel 5. Gotha: Justus Perthes. *Presented by the Publisher.*

United States. **Rand, McNally & Co.**

Indexed County and Township Pocket Maps of Illinois; scale 1: 950,400 or 15 stat. miles to an inch; Indian and Oklahoma Territories, scale 1: 823,680 or 13 stat. miles to an inch; Indiana, scale 1: 696,960 or 11 stat. miles to an inch. Chicago and New York: Rand, McNally & Co., 1902. *Price* $0.25 *each. Presented by the Publishers.*

These are new editions of three of Rand, McNally & Co.'s useful maps of the United States and Territories.

GENERAL.

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich. V. Lieferung. Gotha: Justus Perthes. *Price* 60 *pf.*

This part contains two new maps, one (No. 62) being the northern sheet of a two-sheet map of India and Central Asia, on the scale of 1:7,500,000, and the other (No. 78) the north-east sheet of a four-sheet map of Australia, on the scale of 1:5,000,000. The earlier edition (1891) contained a map similar in area and scale to that of Central Asia (No. 62), and from a comparison of the two it will be seen at a glance how much our geography of the region has advanced during recent years. It is to be regretted that this map has been drawn just too soon to include the results of the surveys of Captain Kozloff's expedition, which have now been published. This is a good, useful map for general reference, but the representation of the relief is not altogether satisfactory owing in great measure to the dark tint that has been superimposed upon the brown hachuring. No. 78 contains the whole of Queensland north of Rockhampton, part of British New Guinea, and the eastern portion of the northern territory of South Australia. It is well drawn and clearly printed.

CHARTS.

Cape Verd Islands. **Commissão de Cartographia, Lisbon.**

Oceano Atlantico Norte. Archipelago de Cabo Verde. Scale 1:500,000 or 7·8 stat. miles to an inch. 1900. Commissão de Cartographia, Lisbon.

North Atlantic Ocean and Mediterranean Sea. **Meteorological Office, London.**

Monthly Pilot Chart of the North Atlantic Ocean and Mediterranean Sea for May, 1902. Meteorological Office, London. *Price* 6*d. Presented by the Meteorological Office.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for April and May, 1902. U.S. Hydrographic Office, Washington, D.C. Uniform Systems of Buoyage as adopted by various Maritime Nations. By Lieut. T. A. Kearney, U.S. Navy. U.S. Hydrographic Office, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Euphrates River. **Huntington, Knapp & Ward.**

Thirty-five photographs of the gorges of the Euphrates and neighbourhood, taken by Messrs. Ellsworth Huntington, G. H. Huntington, G. P. Knapp, and P. T. B. Ward. *Presented by Ellsworth Huntington, Esq.*

These photographs were taken last year during the expedition of Mr. Ellsworth Huntington, of which an account will shortly be given in the *Geographical Journal*. They are small in size, but, generally speaking, well taken and clear. The following is a list of the titles :—

(1) Bridge over the Euphrates at Palu; (2) Crater south of Lake Gyuljuk, looking south-west towards Hazar Baba mountains; Lake Gyuljuk, with Hazar Baba mountains in the distance; (4) An Armenian sheep-dealer, our head servant who took the horses from Akhor to Gerger; (5) Kellek in process of construction; (6) Island Castle, looking up-stream: Rock-hewn stairs and platforms are evident on the middle and left side of the island; (7) Looking up-stream from the Island Castle; (8) Ruined bridge over the Muzur Su, near Mazgerd; (9) Hot springs on the banks of the Peri Su at Baghin; (10) Haldi castle near the Peri Su at Baghin: a typical Turkish scene; (11) Kellek on the Murad Su near Ashvan; (12) Valley of the Kara Su at Egin; (13) Looking up the Kara Su 15 miles below Egin; (14) Making a portage around the rapid 15 miles below Egin; (15) Looking up-stream at the rapid in the Kara Su 15 miles below Egin; (16) Kellek on the Kara Su: one of the two Turkish kellekjis holds up his spoon-shaped walnut paddle; (17) Looking down the Euphrates from the old marble quarry near Geban Maden; (18) Ferry-boat at Maden; (19) Looking up the Euphrates below Geban Maden; (20) In the cañon below Geban Maden; (21) Mouth of a tributary cañon an hour below Geban Maden; (22) Tupli Rock in the gorge an hour below Geban Maden; (23) Fault in the gorge below Geban Maden; (24) Escort of Kizilbash Zaptiehs in Dersim beside a branch of the Muzur Su; (25) Kizilbash Kurd crossing the Euphrates on an inflated sheepskin; (26) Kurdish tent on Sarichichek mountain, near Egin; (27) Entrance to the great cañon at Kemur Khan, looking south; (28) Looking up the Euphrates from a camp at the beginning of the Kemur Khan gorge below the first portage; (29) Looking down the Euphrates at Tilek: Hot spring at left; (30) Cañon of the Euphrates river cut through a small ridge between Chunkush and Gerger; (31) Zaza Kurds on the ruins of an old Syrian church on the right bank of the Euphrates at Helim, near Gerger; (32) Group of Zaza Kurds, women and children, at Helim; (33) Looking up-stream in the cañon of the Euphrates at Morfa, just south of the Gerger ridge; (34) Gerger castle from the south-west; (35) An Armenian family at Gerger.

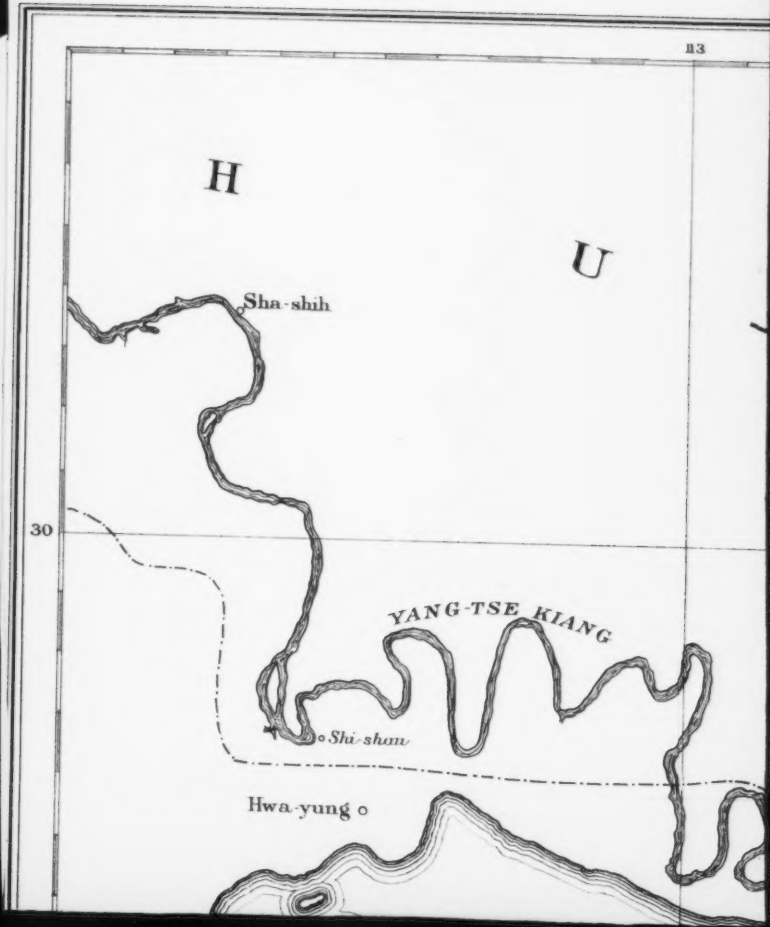
North America. **Marsden.**

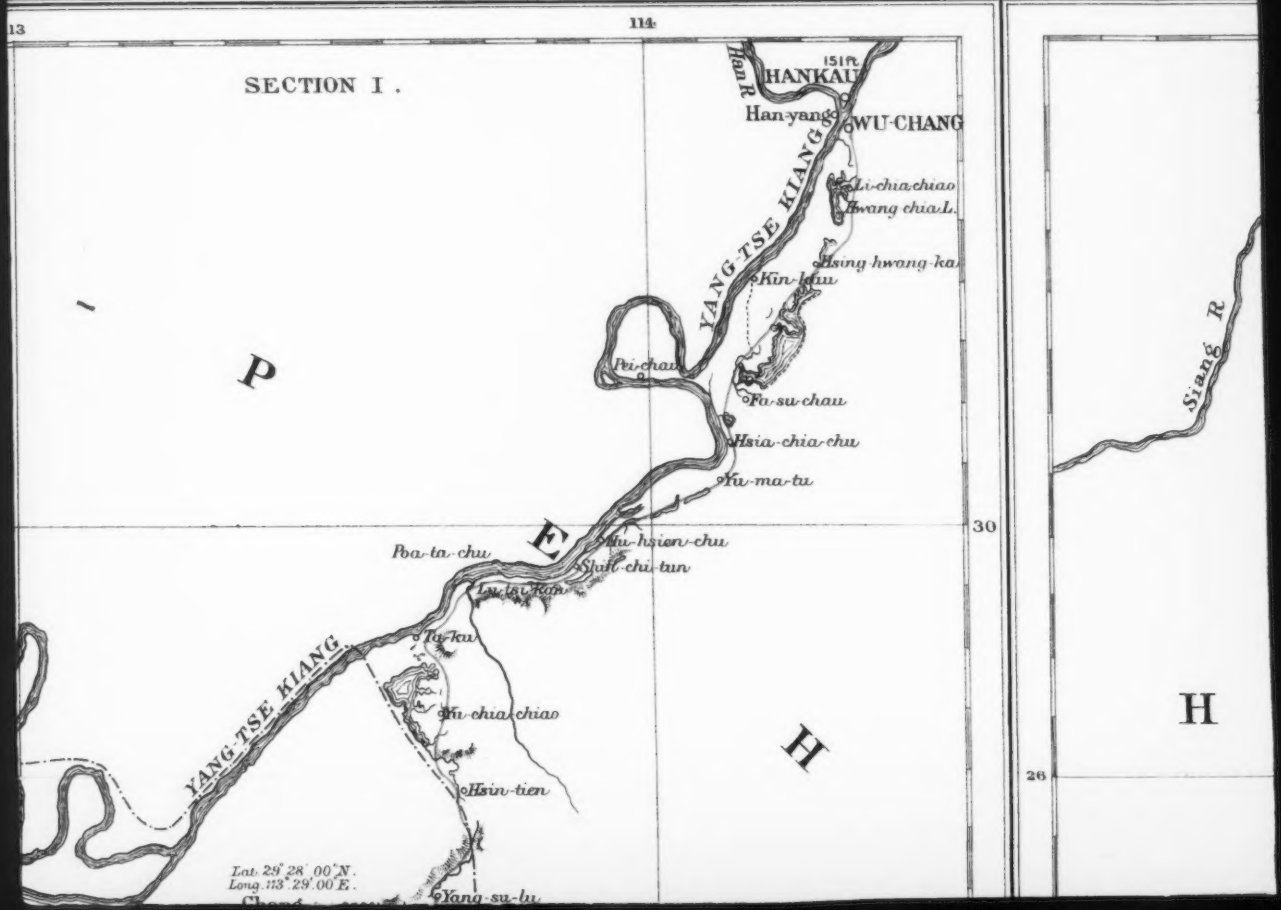
Twelve photographs of Alaska, and Herschel Island near the mouth of the Mackenzie River. Taken by Maurice Marsden, Esq. *Presented by Maurice Marsden, Esq.*

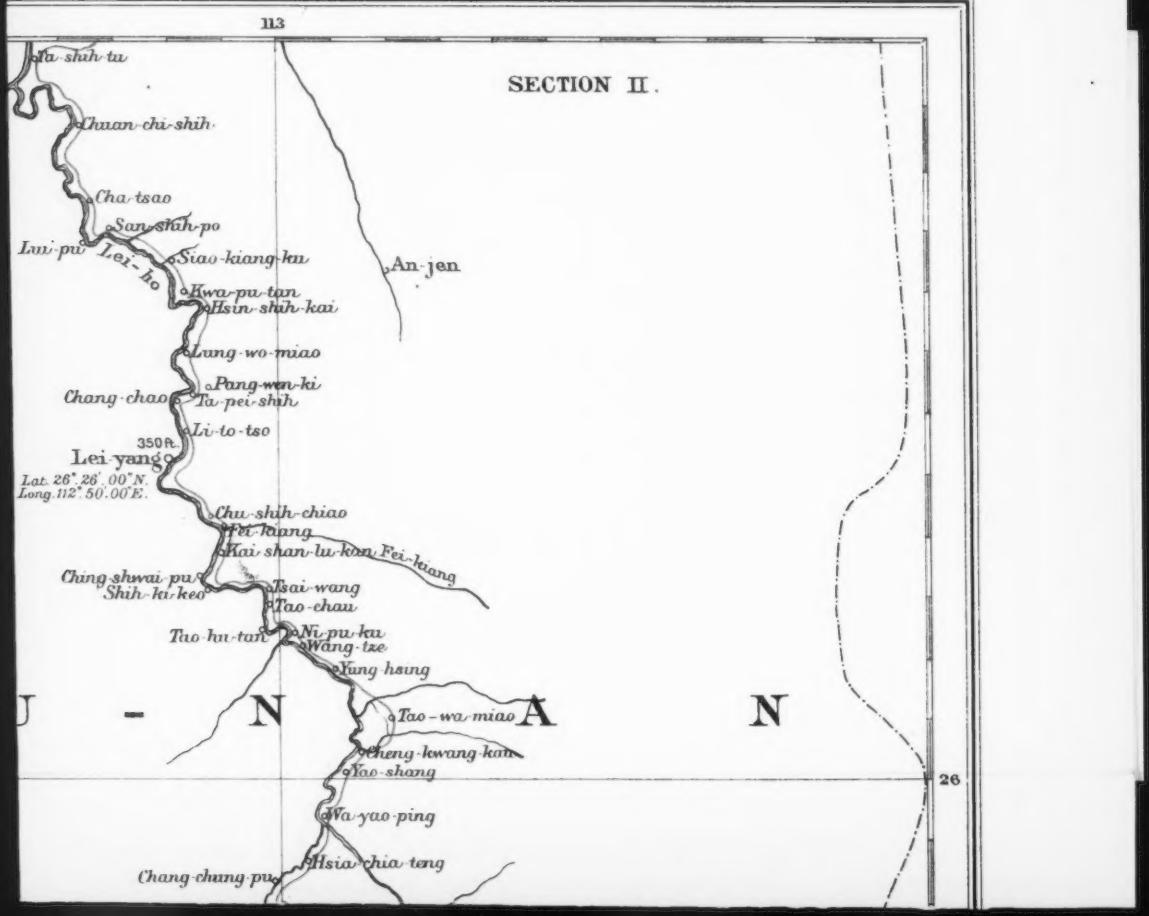
As few photographs have been taken of this region, these form a welcome addition to the Society's collection, although some of them are not very good specimens :—

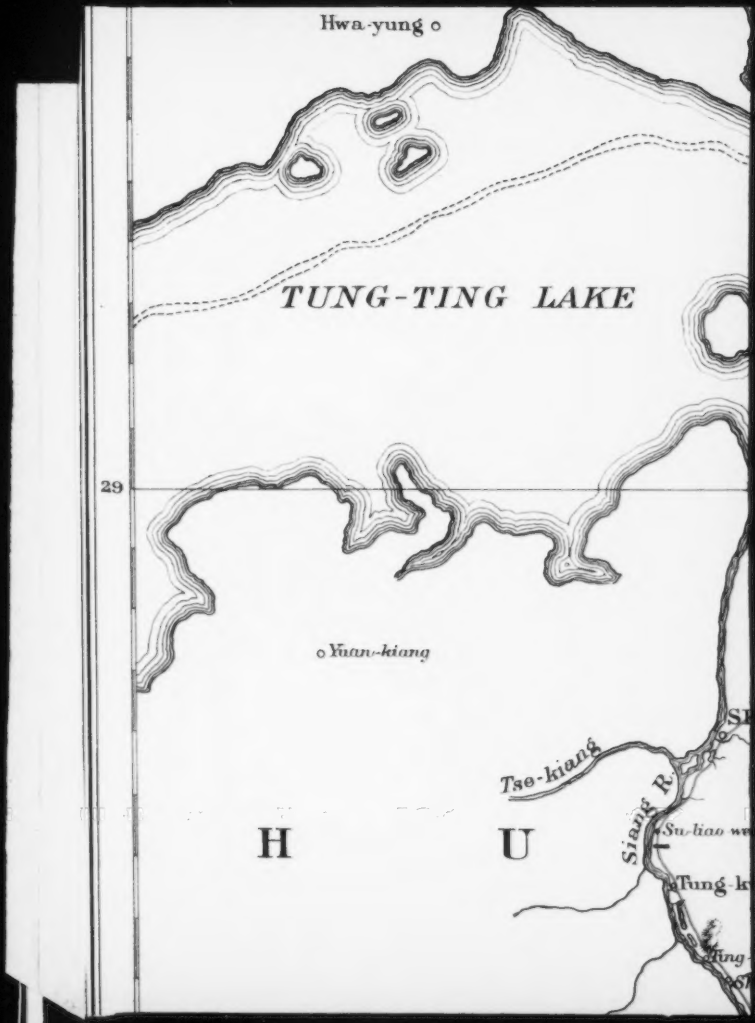
(1) Whaling station on Herschel island, mouth of Mackenzie river; (2) Whaling fleet at Herschel island; (3) Esquimaux children, Herschel island; (4) Itgillik and child, natives of the district near Herschel island; (5) The *Orca*, largest whaler of the Arctic fleet, north of Point Barrow; (6) On an iceberg in a snowstorm north of Point Barrow; (7) Steam whalers off the north coast of Alaska; (8) *Karluq*, steam whaler, north of Point Barrow; (9) Return Reef, furthest westerly point reached by Sir John Franklin; (10) *Jeannette*, steam whaler, near Blossom shoals: the ship in the background is badly pinched; (11) Steam whaler; (12) Dutch harbour, Unalaska.

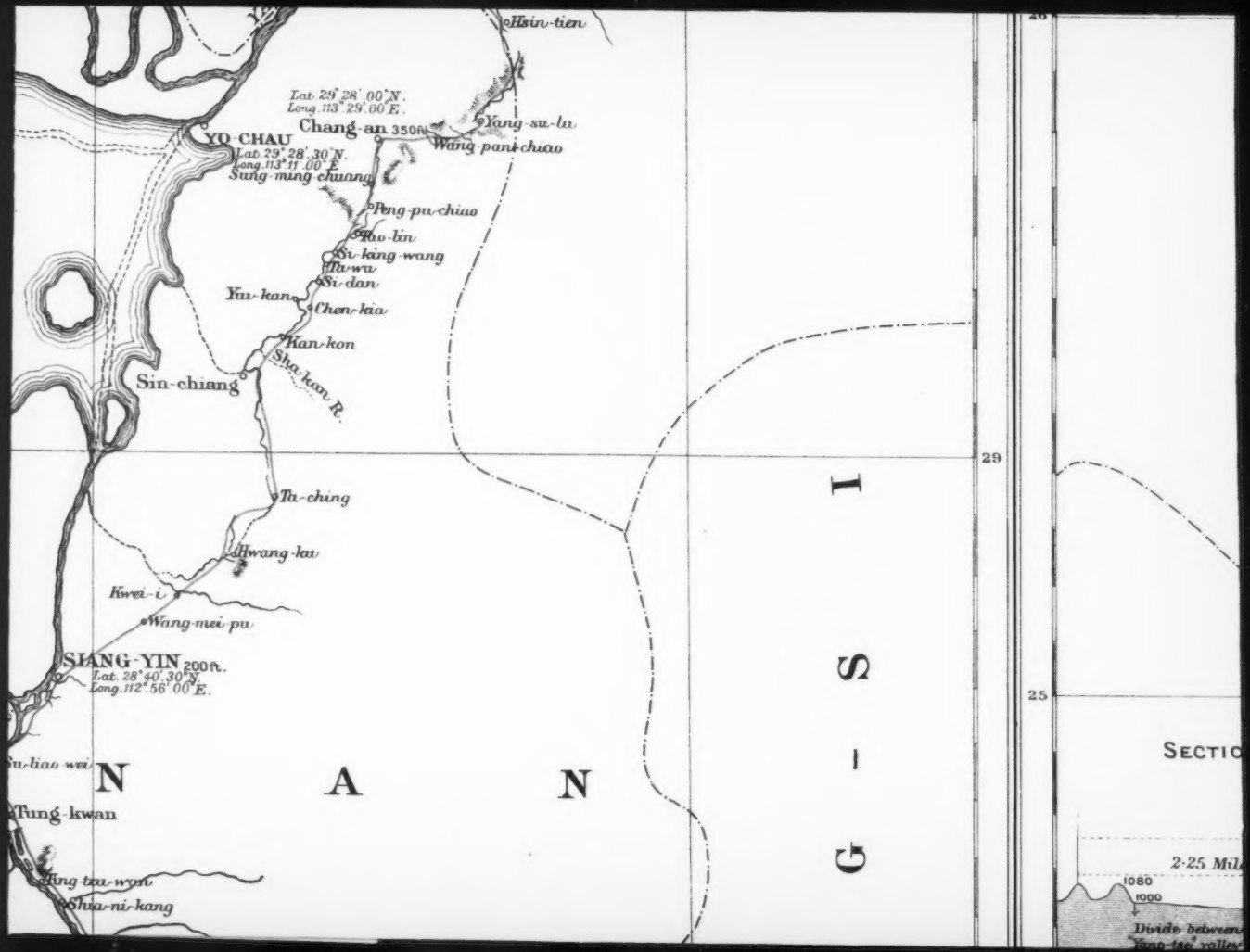
N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

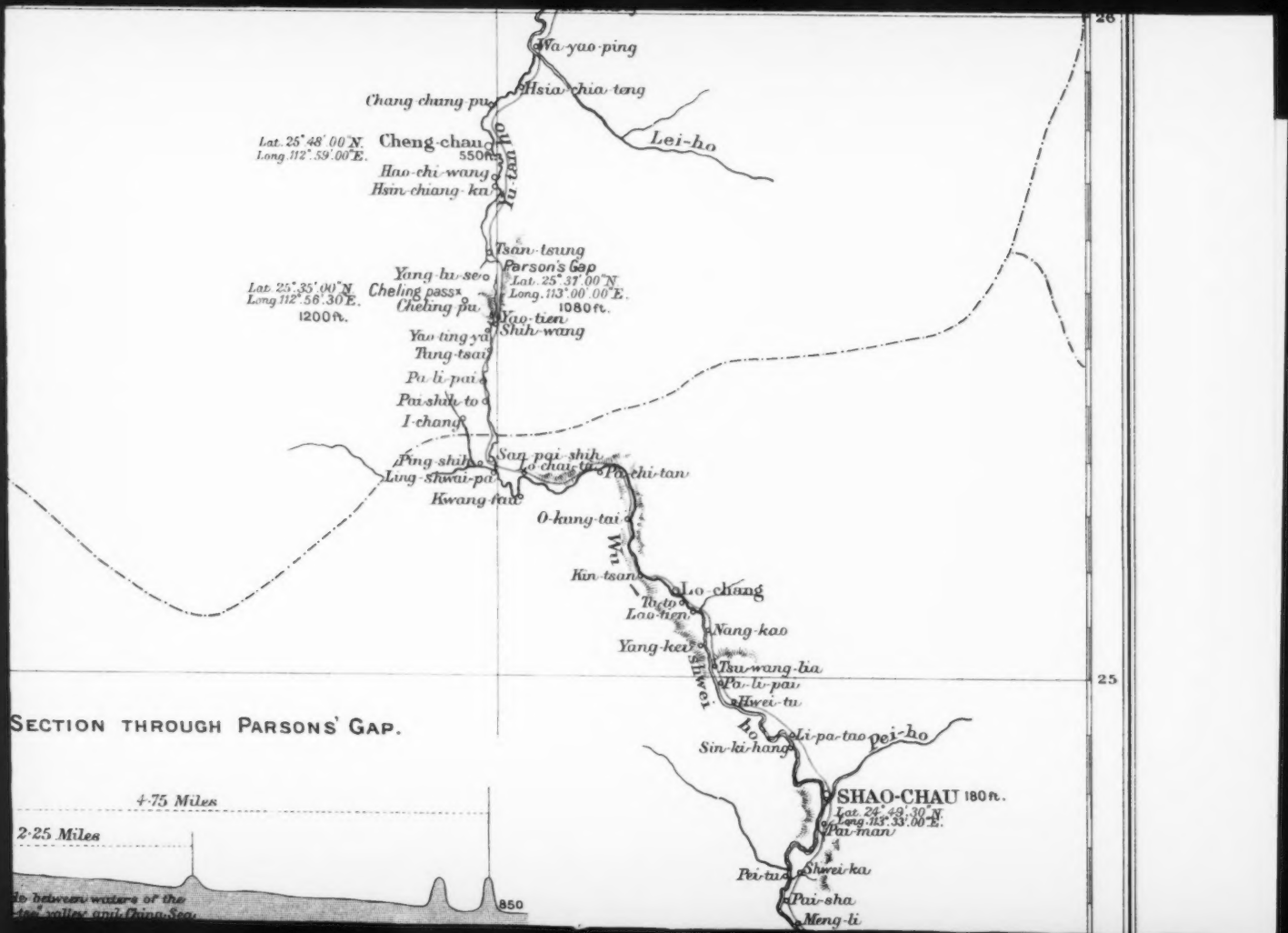

113
H
U
Sha-shih
30
YANG-TSE KIANG
Shi-shan
Hwa-yung

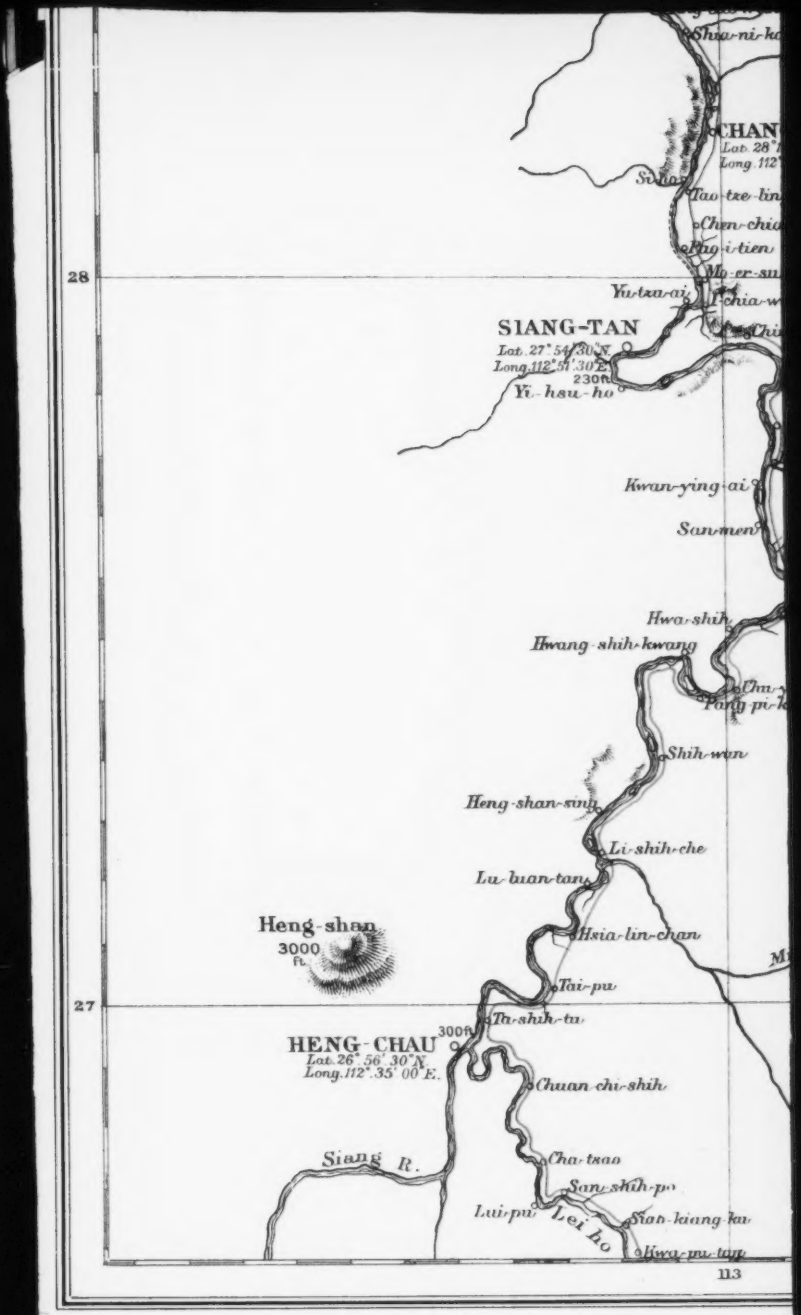

13
114
SECTION I.
151ft
HANKAU
Han R
Han-yang
WU-CHANG
YANG-TSE KIANG
Li-chia-chiao
Hwang chia-L.
Hsing hwang-kai
Kin-kau
Pei-chau
Fa-su-chau
Hsia-chia-chu
Yu-ma-tu
30
Hu-hsien-chu
Shui-chi-tun
Lu-la-Kan
Ta-kau
Yu-chia-chiao
Hsin-tien
Lat. 29° 28' 00" N.
Long. 113° 29' 00" E.
Yang-su-lu
P
E
H
H
Siang R
26

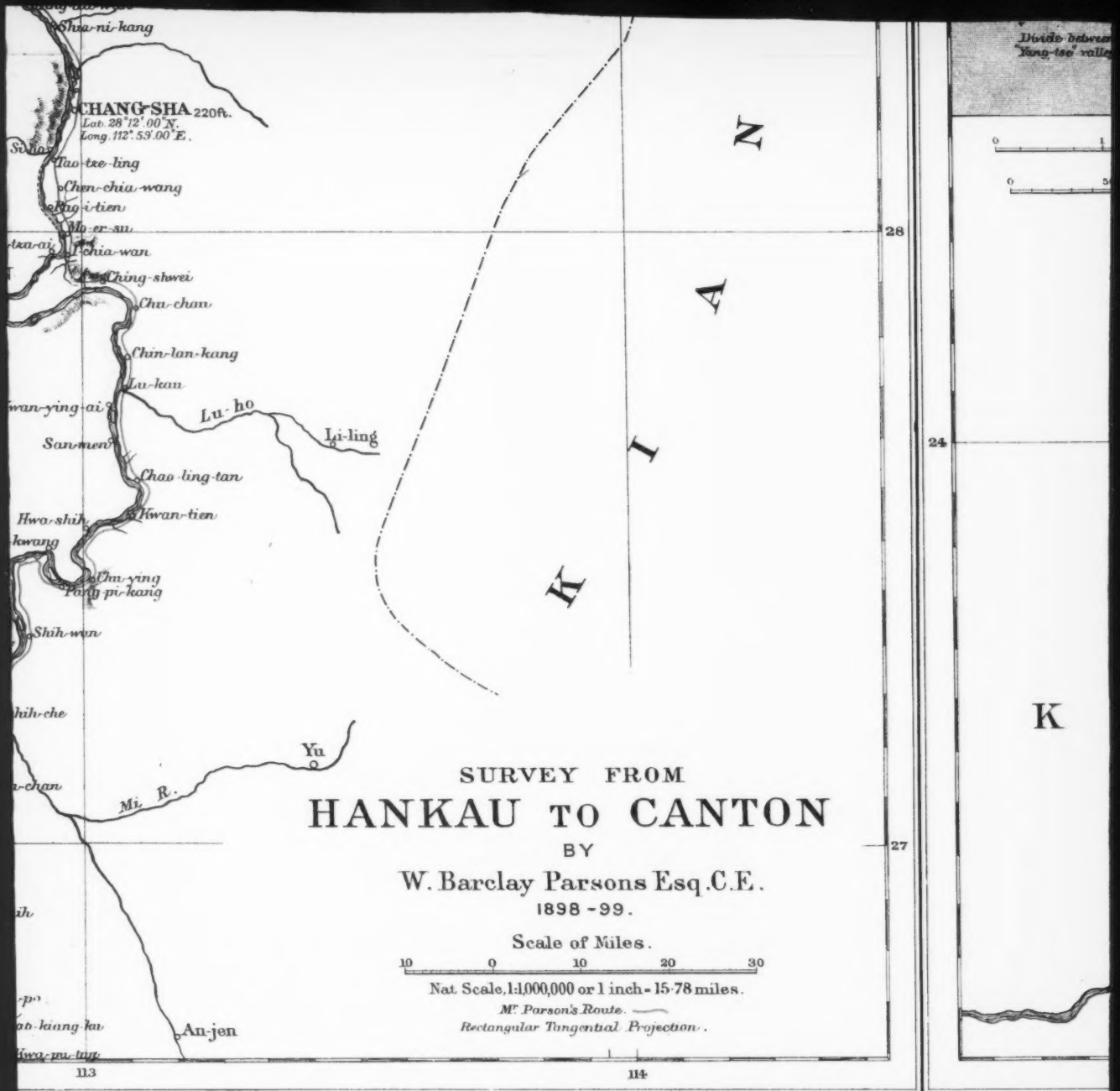

113
SECTION II.
Ta-shuh-tu
Chuan-chi-shih
Cha-tsao
San-shah-po
Lui-pu
Lei-ho
Siao-kiang-ka
An-jen
Kwa-pu-tan
Hsin-shih-kai
Lung-wo-miao
Pang-wan-ki
Chang-chao
Ta-pei-shih
Li-to-tso
350 ft.
Lei-yang
Lat. 26° 26' 00" N.
Long. 112° 50' 00" E.
Chu-shih-chiao
Fei-kiang
Kai-shan-lu-kan Fei-kiang
Ching-shwai-pu
Shih-ki-keo
Tsai-wang
Tao-chau
Tao-hu-tan
Ni-pu-ka
Wang-tze
Yang-hsing
Tao-wa-miao
Cheng-kwang-kan
Yao-shang
Wa-yao-ping
Hsia-chia-teng
Chang-chung-pu
26


Hwa-yung
TUNG-TING LAKE
29
Yuan-kiang
Tse-kiang
Siang R.
H
U
Su-kiao
Tung-k

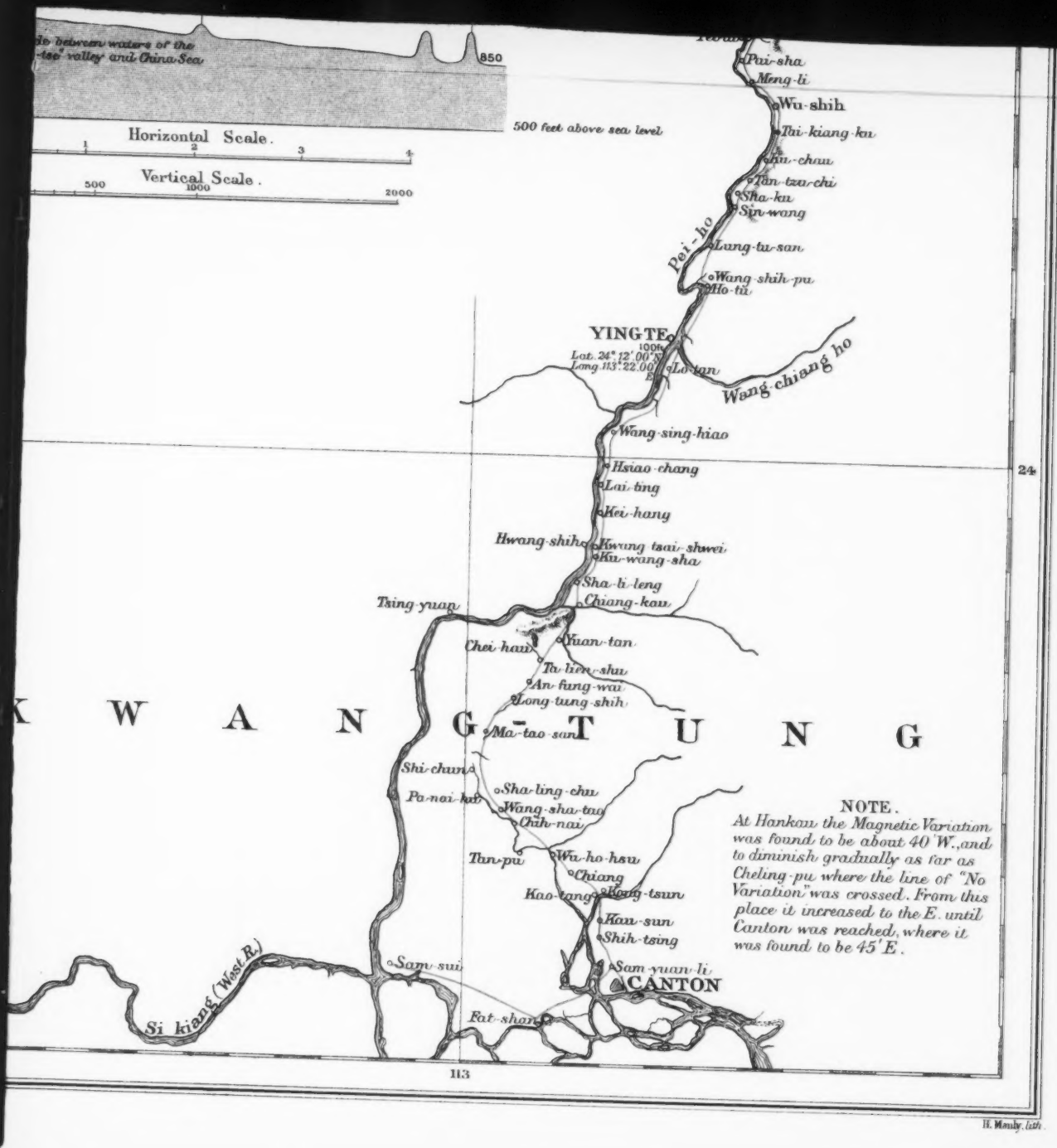

Hsin-tien
Lat. 29° 28' 00" N.
Long. 113° 29' 00" E.
Yang-su-lu
Chang-an 350ft.
Wang-pan-chiao
YO CHAU
Lat. 29° 28' 30" N.
Long. 113° 11' 00" E.
Sung-ming chuang
Peng-pu-chiao
Hao-lin
Su-kang-wang
Ha-wa
Si-dan
Yin-kan
Chen-kia
Kan-kon
Sha-kan R.
Sin-chiang
Ta-ching
Hwang-kau
Kwei-i
Wang-mei-pu
SIANG-YIN 200ft.
Lat. 28° 40' 30" N.
Long. 112° 56' 00" E.
Su-liao wei
N A N
G - S I
Tung-kwan
Ting-tsu-wan
Shui-ni-kang
29
25
SECTIO
2·25 Mil
1080
1000
Divide between

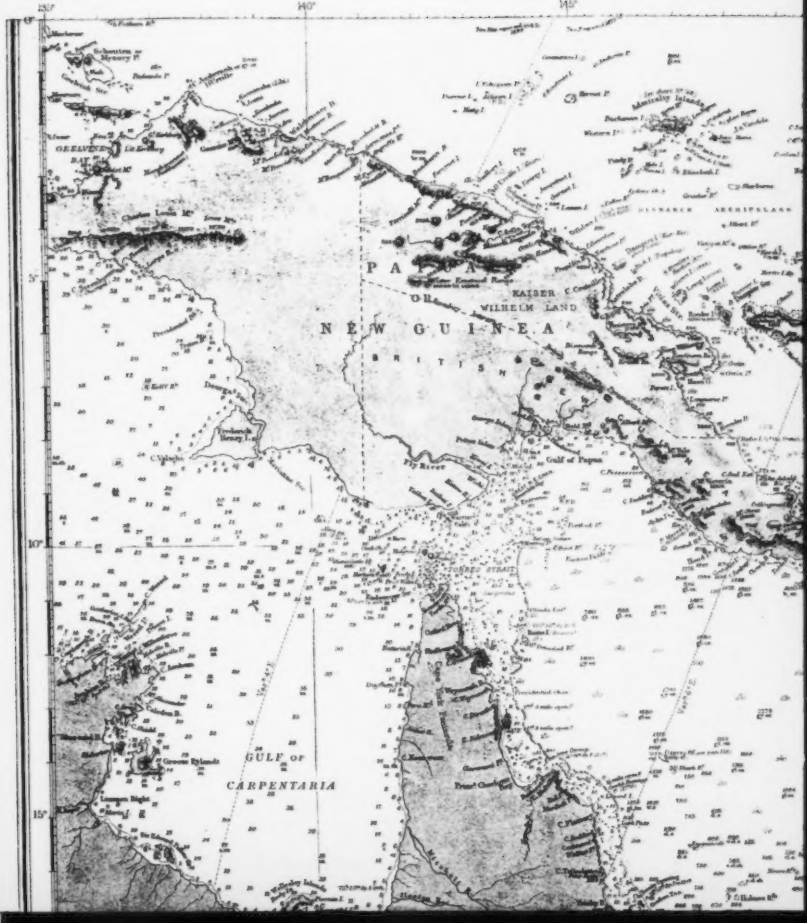

Wa-yao-ping
Chang chung pu
Hsia-chia-tang
Lei-ho
Lat. 25° 48' 00" N.
Long. 112° 59' 00" E.
Cheng-chau
550ft.
Hao-chi-wang
Hsin-chiang-kai
Yu-tan ho
Tsan-tsung
Parson's Gap
Lat. 25° 37' 00" N.
Long. 113° 00' 00" E.
1080ft.
Yang-hu-seo
Lat. 25° 35' 00" N.
Long. 112° 56' 30" E.
1200ft.
Cheling pass
Cheling pu
Yao-tien
Shih-wang
Yao-ting-yu
Tung-tsai
Pu-li-pai
Pai-shih-to
I-chang
Ping-shih
Lung-shwai-pa
San-pai-shih
Lo-chai-ta
Pa-chi-tan
Kwang-tau
O-kang-tai
Wu
Kin-tsan
Lo-chang
Ta-to
Lao-tien
Nang-kao
Yang-kei
Shwei
Tsu-wang-ha
Pa-li-pai
Hwei-tu
Sin-ki-hang
Li-pa-tao
Pei-ho
SHAO-CHAU 180ft.
Lat. 24° 48' 30" N.
Long. 113° 33' 00" E.
Pai-man
Pei-tu
Shwei-ka
Pai-sha
Meng-li
26
25
SECTION THROUGH PARSONS' GAP.
4·75 Miles
2·25 Miles
850

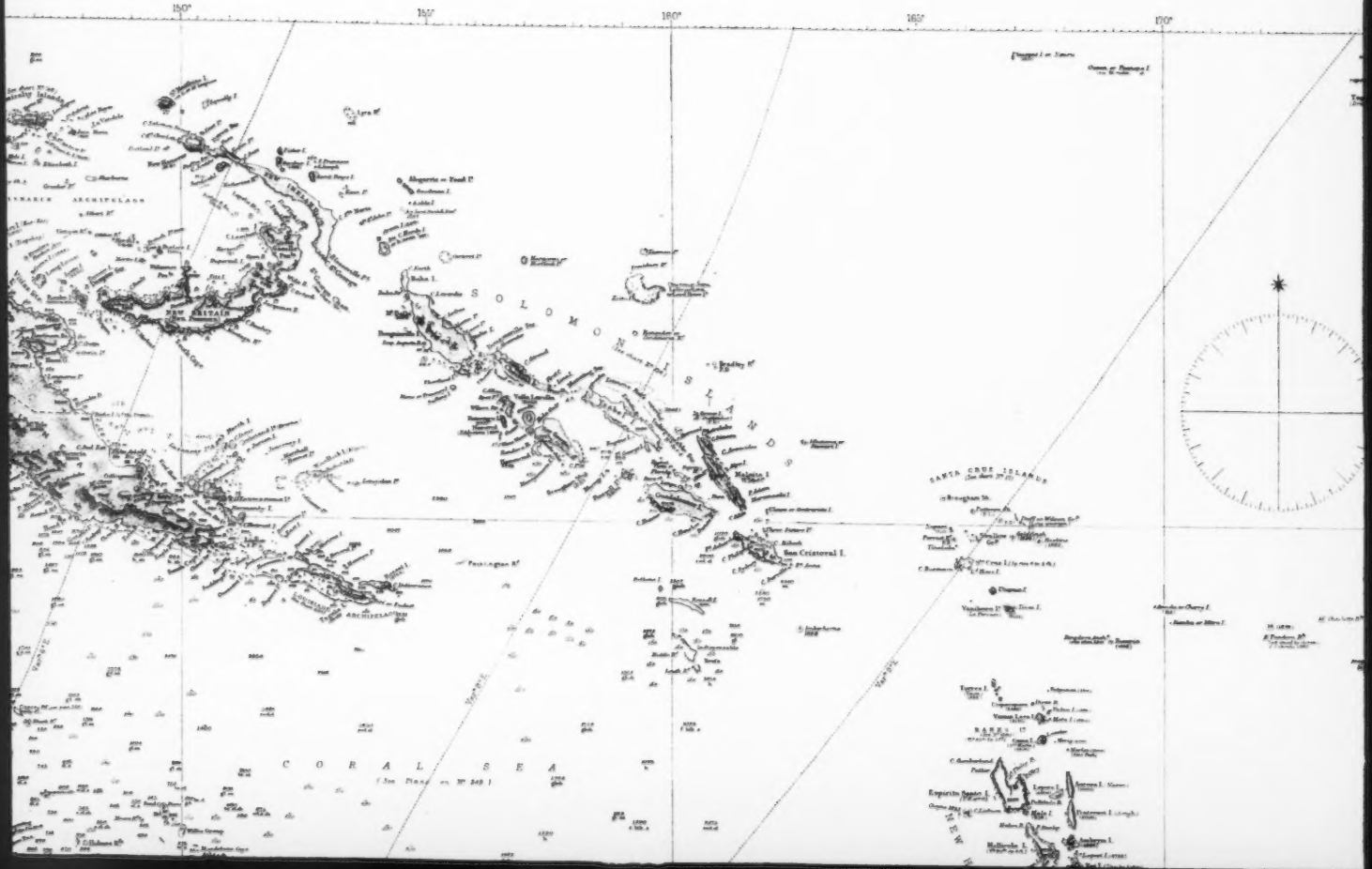

Shua-ni-ka
CHAN
Lat. 28°
Long. 112°
Tao-tze-lin
Chun-chia
Ma-er-su
28
Yu-tza-ai
SIANG-TAN
Lat. 27° 54' 30" N.
Long. 112° 51' 30" E.
230ft.
Yi-hsu-ho
Kwan-ying-ai
San-men
Hwa-shih
Hwang-shih-kwang
Shih-wan
Heng-shan-sun
Li-shih-che
Lu-tuan-tan
Heng-shan
3000
ft.
Hsia-lin-chan
Tai-pu
27
Ta-shih-tu
300ft.
HENG-CHAU
Lat. 26° 56' 30" N.
Long. 112° 35' 00" E.
Chuan-chi-shih
Siang R.
Cha-tsao
San-shih-pu
Lui-pu
Lei ho
Hwa-pu-tan
113

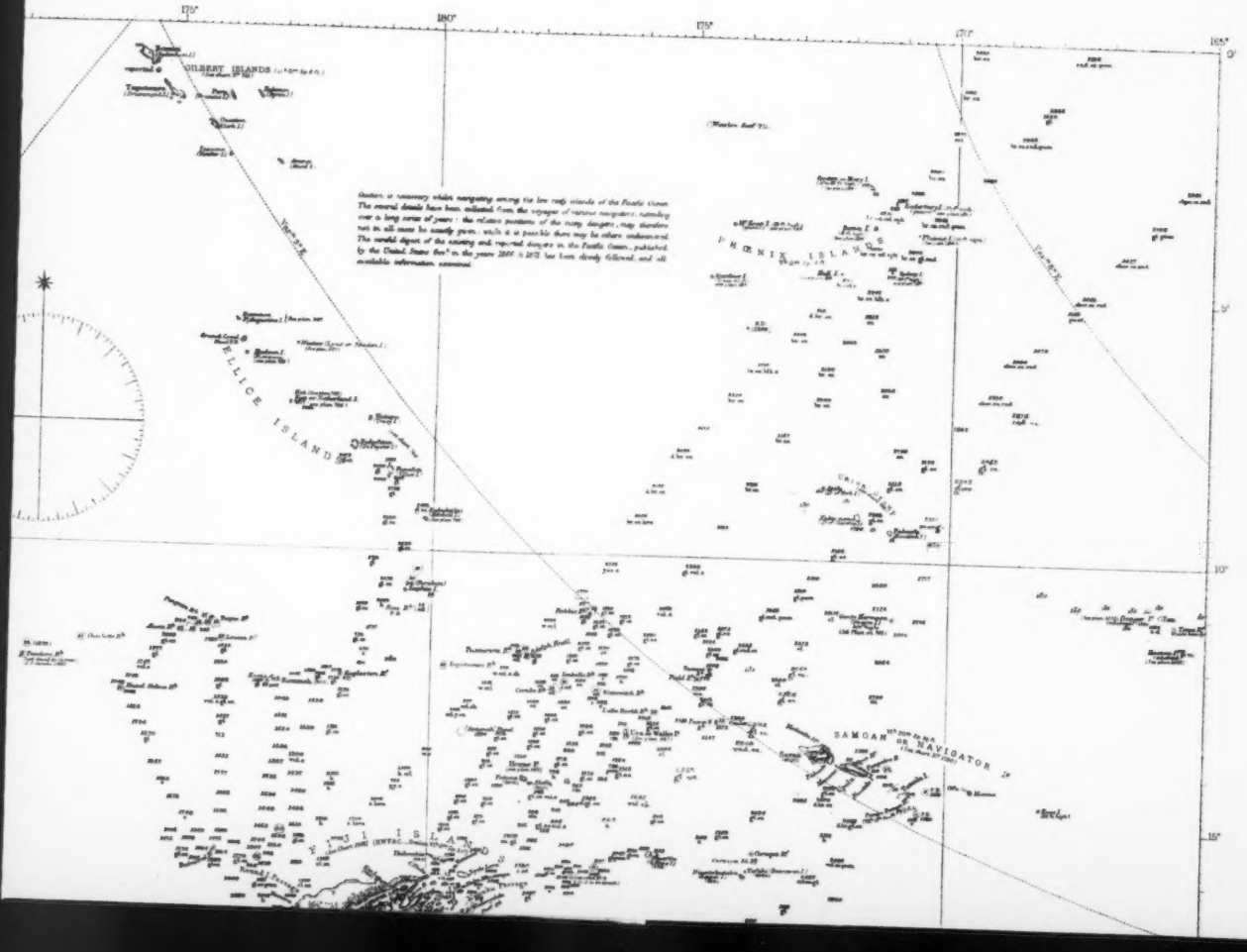


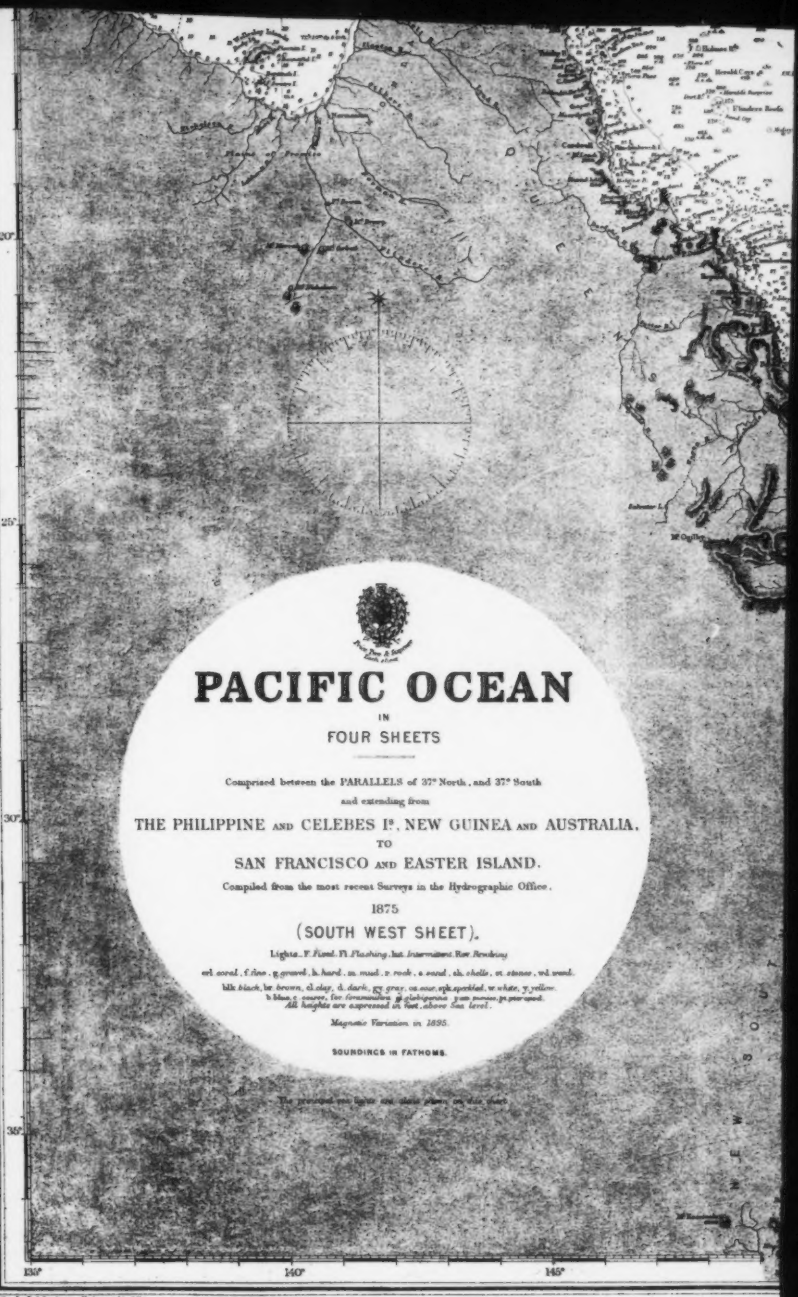
Published by the Royal Geographical Society.


...to between waters of the
...tse' valley and China Sea
850
500 feet above sea level
Horizontal Scale.
1 2 3 4
Vertical Scale.
500 1000 2000
Pai-sha
Mang-li
Wu-shih
Tai-kiang-kau
Liu-chau
Tan-tza-chi
Sha-kau
Sin-wang
Pei-ho
Lung-tu-san
Wang-shih-pu
Ho-tu
YING TE
1006
Lat. 24° 12' 00" N.
Long. 113° 22.00' E.
Lo-tan
Wang-chiang ho
Wang-sing-hiao
24
Hsiao-chang
Lai-ting
Kei-hang
Hwang-shih
Kwang-tsai-shwei
Ku-wang-sha
Sha-li-leng
Tsing-yuan
Chiang-kau
Chei-hau
Yuan-tan
Ta-lien-shu
An-fung-wai
Long-tung-shih
K W A N G - T U N G
Ma-tao-san
Shi-chun
Sha-ling-chu
Pa-nei-hu
Wang-sha-tau
Ouh-nai
Tan-pu
Wu-ho-hsu
Chiang
Kao-tang
Kong-tsun
Kau-sun
Shih-tsing
Sam-yuan-li
CANTON
Sam-sui
Si kiang (West R.)
Fat-shan
113
NOTE.
At Hankau the Magnetic Variation was found to be about 40' W., and to diminish gradually as far as Cheling-pu where the line of "No Variation" was crossed. From this place it increased to the E. until Canton was reached, where it was found to be 45' E.
H. Mauly. lith.

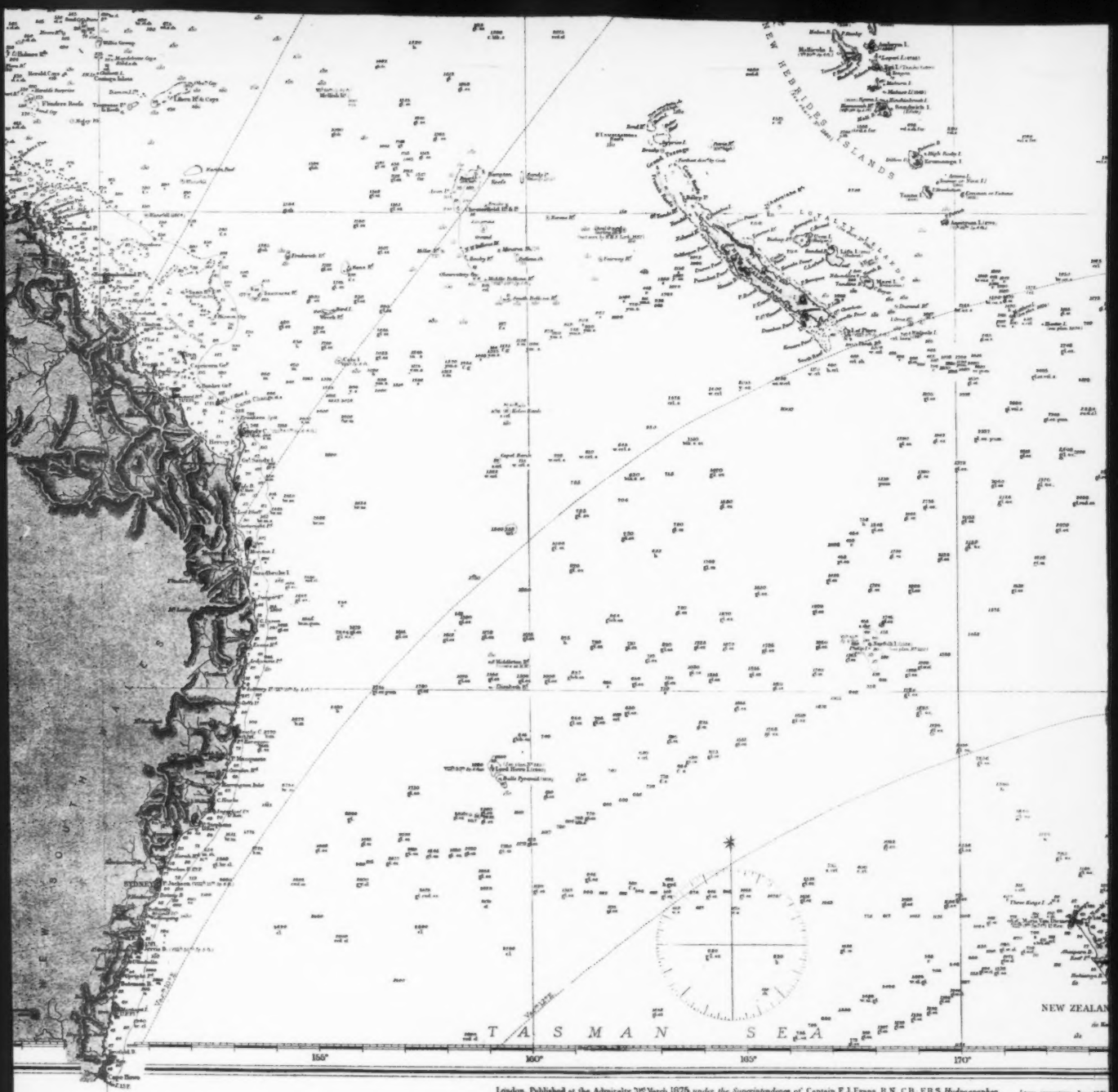

NEW GUINEA
BRITISH
KAISER WILHELM LAND
GULF OF CARPENTARIA
Gulf of Papua
Torres Strait


150°
160°
170°
SOLOMON ISLANDS
CORAL SEA
NEW BRITAIN
SANTA CRUZ ISLANDS

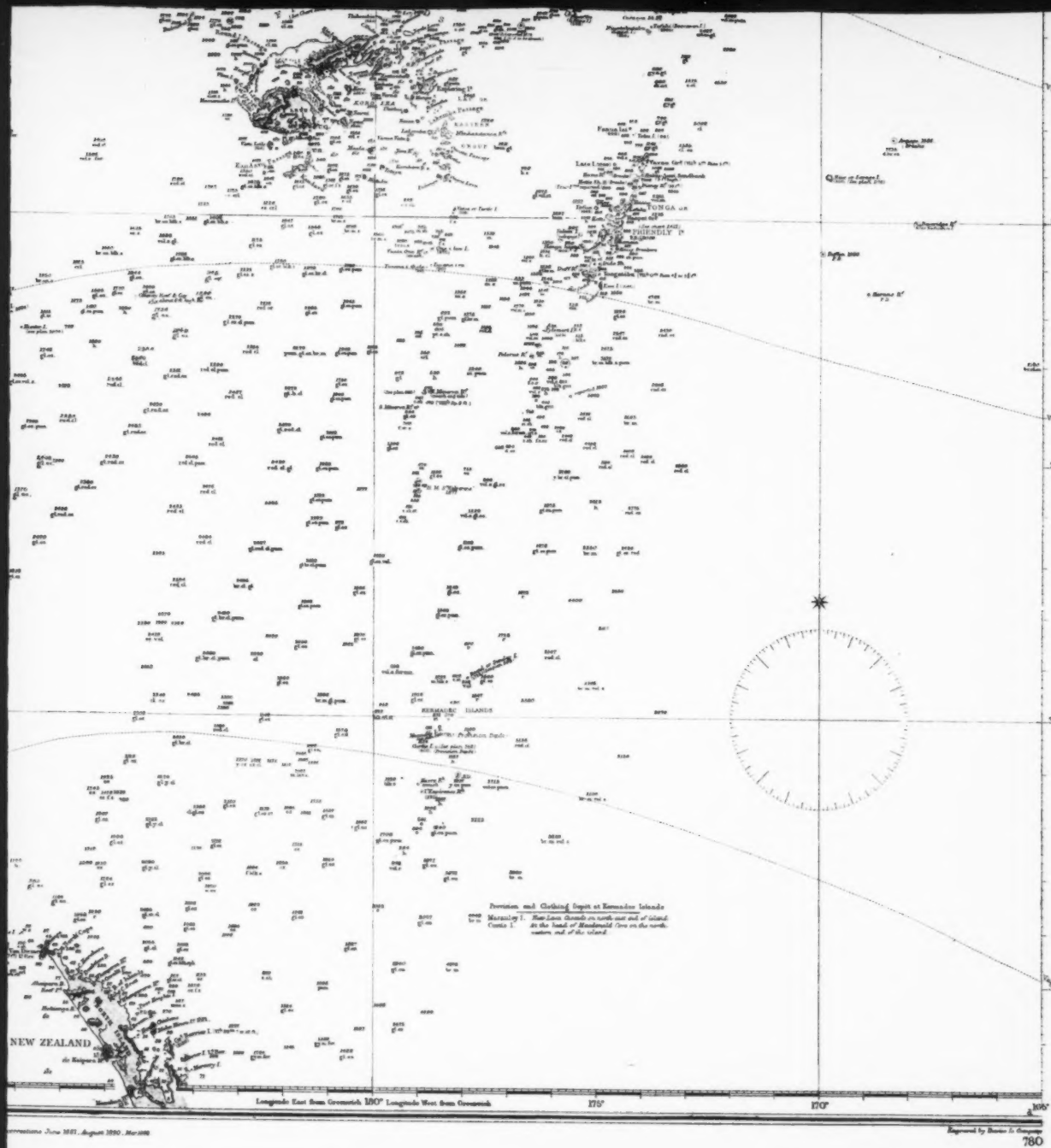

175°
180°
175°
170°
165°
0°
5°
10°
15°
GILBERT ISLANDS
PHOENIX ISLANDS
ELLICE ISLANDS
SAMOAN OR NAVIGATOR IS.
Tropic of Cancer
Tropic of Capricorn
Equator
Western or mariners, while navigating among the low reefy islands of the Pacific Ocean.
The several details have been collated, from the voyages of various navigators, extending
over a long series of years: the relative positions of the many dangers, may therefore
not in all cases be exactly given, which it is possible there may be others unknown and.
The careful depot. of the existing and reported dangers in the Pacific Ocean, published
by the United States Gov.t in the years 1866 & 1872 has been closely followed, and all
available information consulted.


PACIFIC OCEAN
IN
FOUR SHEETS
Comprised between the PARALLELS of 37° North, and 37° South
and extending from
THE PHILIPPINE AND CELEBES Is., NEW GUINEA AND AUSTRALIA,
TO
SAN FRANCISCO AND EASTER ISLAND.
Compiled from the most recent Surveys in the Hydrographic Office.
1875
(SOUTH WEST SHEET).
Lights.-F. Fixed. Fl. Flashing. Int. Intermittent. Rev. Revolving.
crl. coral. f. fine. g. gravel. h. hard. m. mud. r. rock. s. sand. sh. shells. st. stones. wd. weed.
blk. black. br. brown. cl. clay. d. dark. gy. gray. co. coar. spk. sparkled. w. white. y. yellow.
b. blue. c. coarse. for. foraminifera. gl. globigerina. p. pumice. pt. pteropod.
All heights are expressed in feet, above Sea level.
Magnetic Variation in 1895.
SOUNDINGS IN FATHOMS.
The principal tint lights are shewn thus on this sheet.
20°
25°
30°
35°
130°
140°
145°

(3255)



London. Published at the Admiralty, 31st March 1875 under the Superintendence of Captain F.J. Evans. R.N. C.B. F.R.S. Hydrographer. Large corrections June 1881
Sold by J.D. Potter, Depot for the sale of the Admiralty Charts &c. 31 Poultry, & 11 King Street Tower Hill


NEW ZEALAND
TONGA OR
FRIENDLY I.S
KERMADEC ISLANDS
Provision and Clothing Depot at Kermadec Islands
Macauley I. New Lava Canoe on north east end of island.
Curtis I. At the head of Macdonald Cove on the north western end of the island.
Longitude East from Greenwich 180° Longitude West from Greenwich
175°
170°
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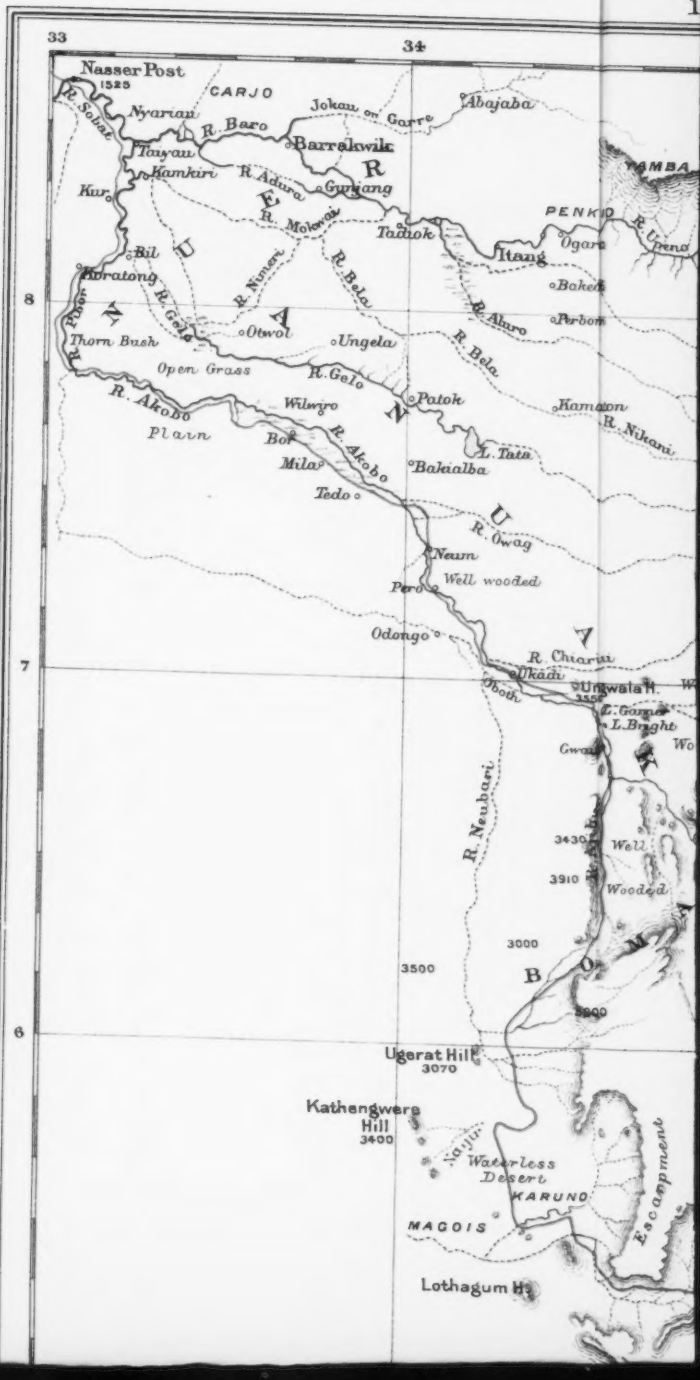

ASER TO THE UGANDA RAILWAY AT LAKE NAKURO.

By
MJOR H. H. AUSTIN, C.M.G., D.S.O., R.E.

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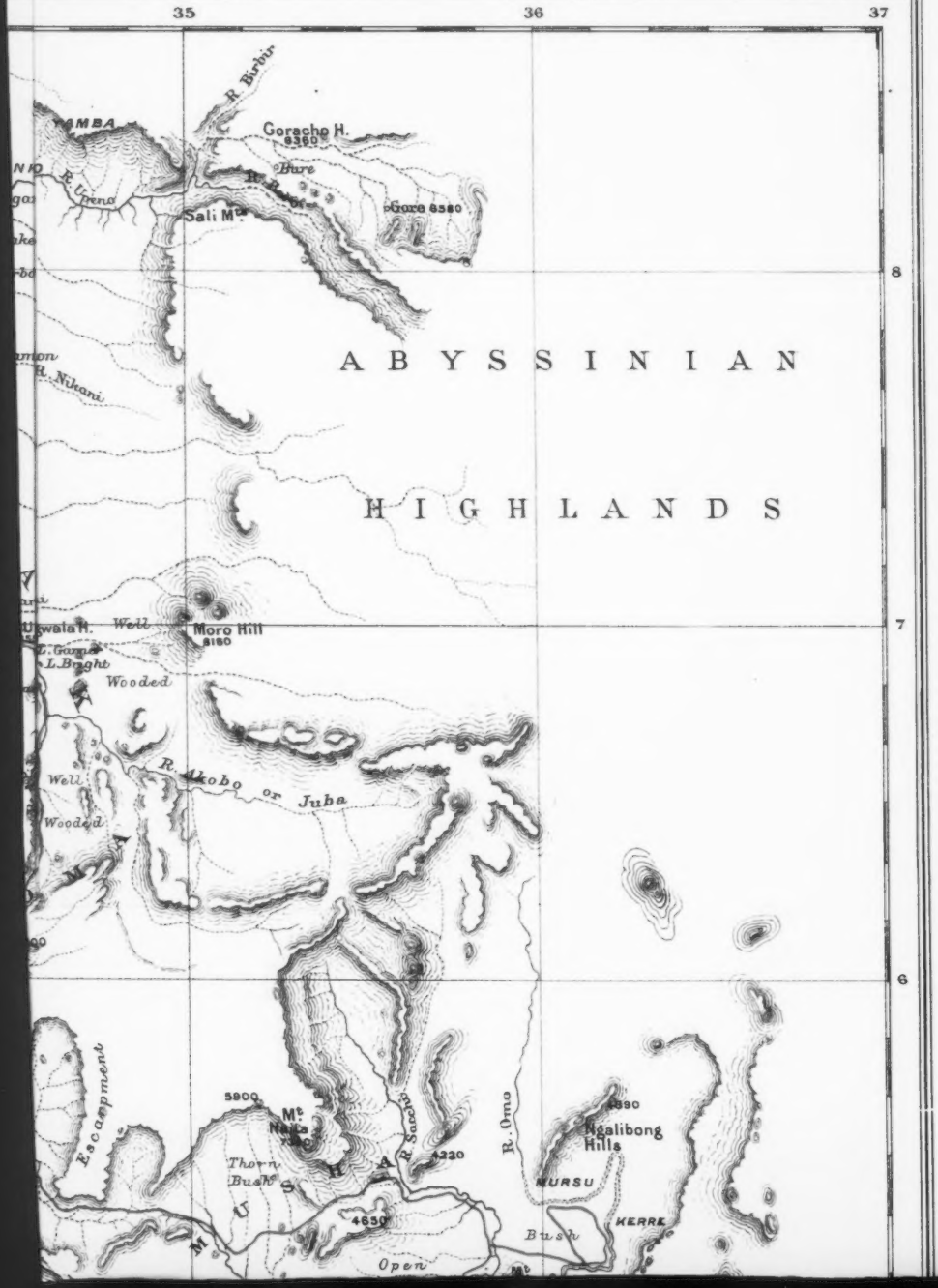

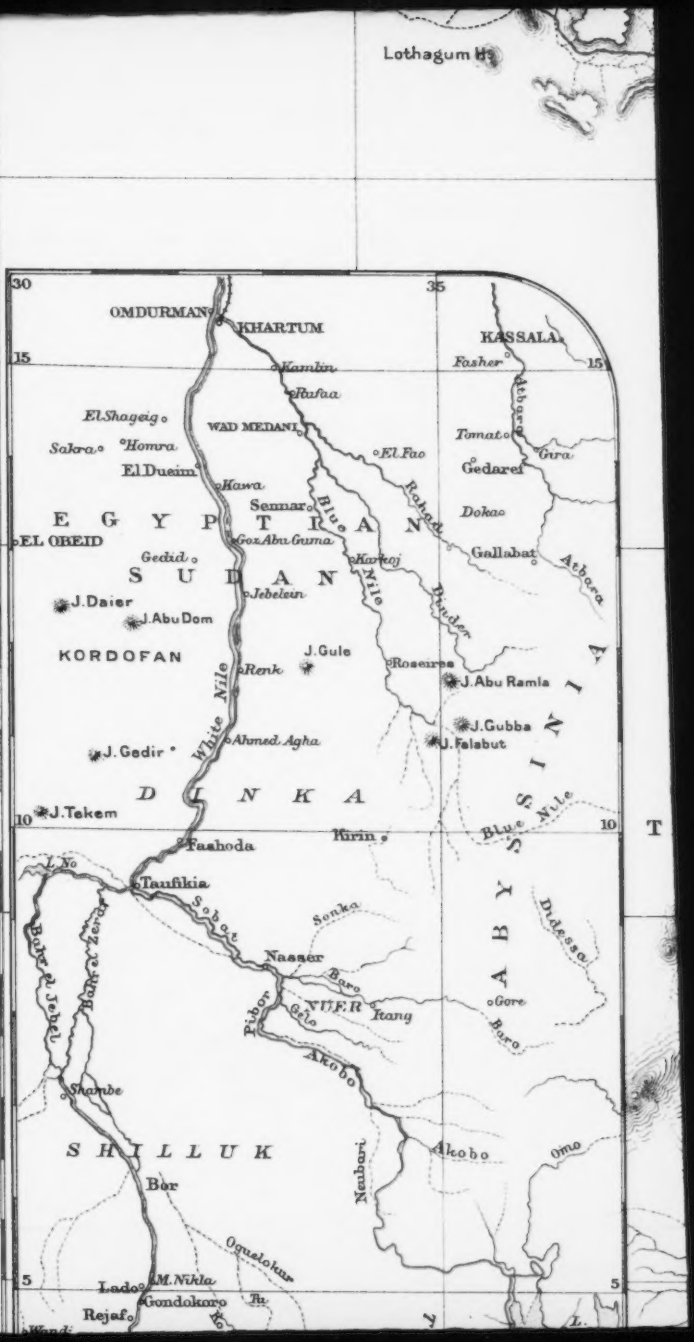
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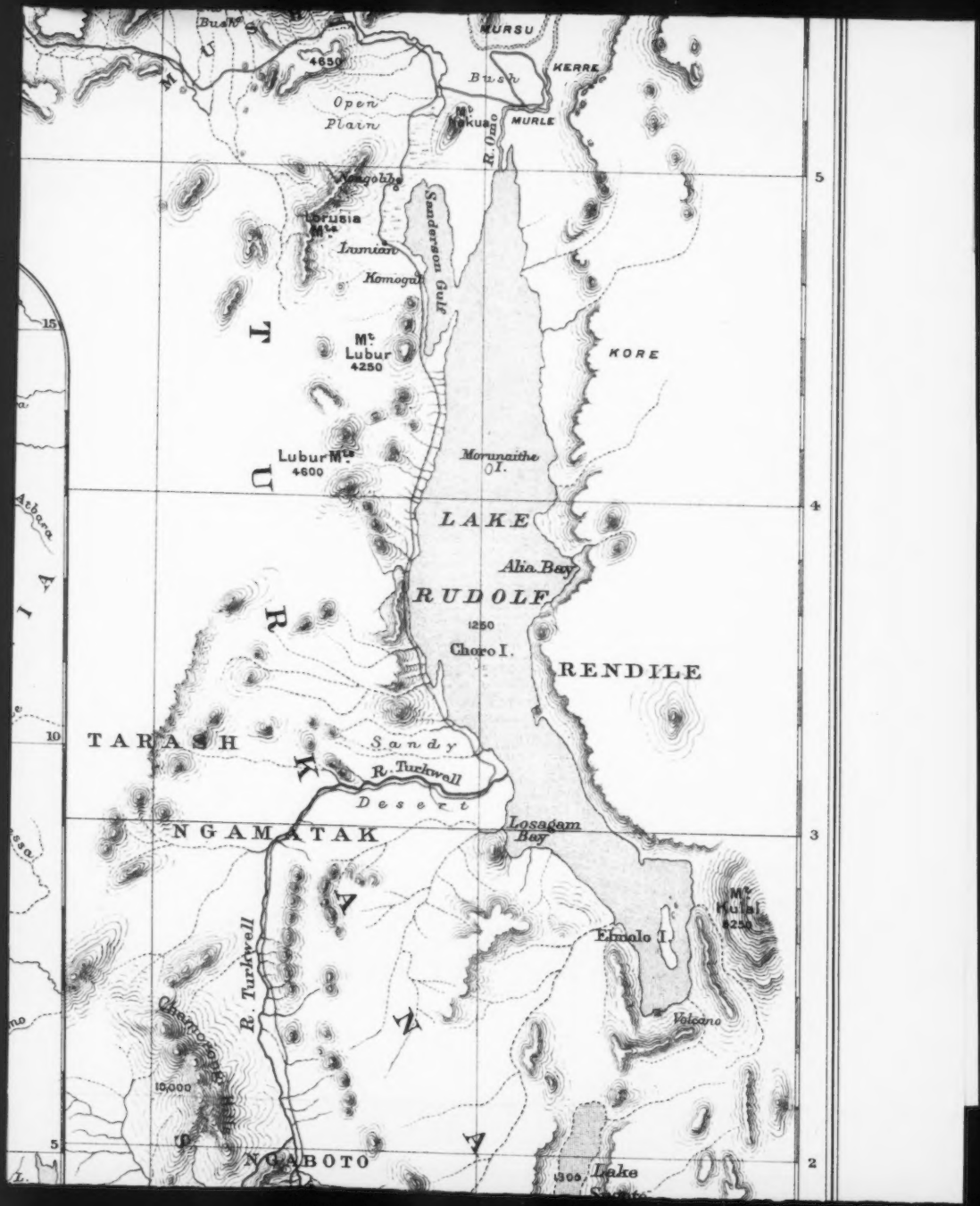
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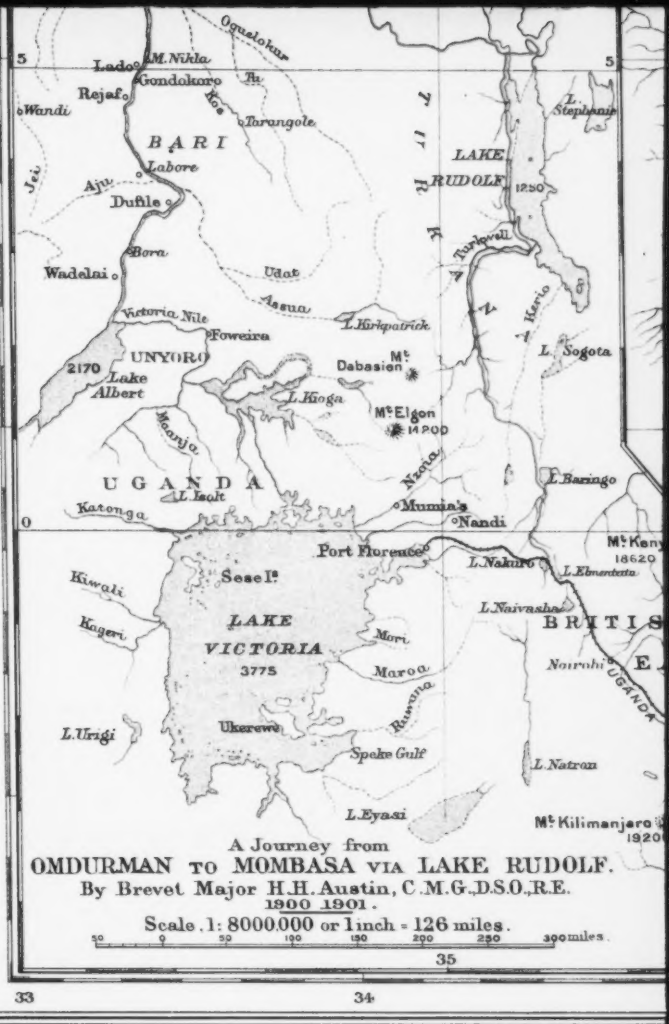

A Journey from

OMDURMAN TO MOMBASA VIA LAKE RUDOLF.

By Brevet Major H.H. Austin, C.M.G., D.S.O., R.E.

1900 1901.

Scale. 1: 8000.000 or 1 inch = 126 miles.

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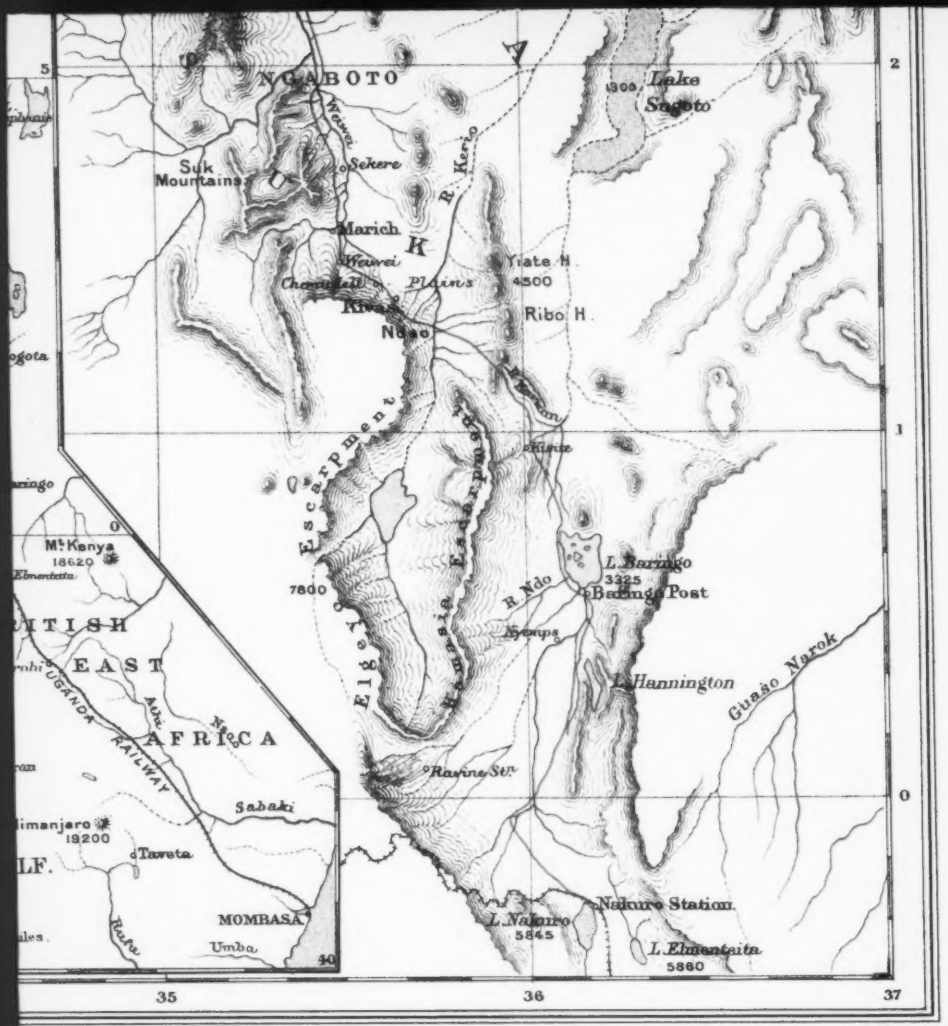

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Major Austin's Route

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INDEX.

* Denotes Articles and Papers. † New Publications and Maps.

A.

Abbassia Observatory, Cairo, Report on the Meteorological Observations made at the, 232 †
Abercrombie, Mount, Alaska, 610
Abruzzi, Duke of the, Farther North than Nansen, 779 †
Abu Thabi, Oman, 55, 59
Abyssinia—
  Abessinien als Goldland, von Major K. von Bruchhausen, 771 †
  Aitjopija, von F. J. Bieber, 770 †
  Expedition in, under M. Du Bourg de Bogas, 755
  Ménélik et Nous, par H. Le Roux, 654 †
  Southern, M. Le Roux's Explorations in, 87
  Sporting Trip through, by P. H. G. Powell-Cotton, 770 †
  Voyage au Oullaga. Itinéraire d'Addis-Ababâ au Nil Bleu, par H. Le Roux, 397 †
Acoustic Phenomena—
  Akustisch - Geographische Probleme, von S. Günther, 406 †
Adams, C. C., A Text-Book of Commercial Geography, 408 †; review of, by G. G. Chisholm, 747
Adams, Rev. I., Persia by a Persian, 769 †
Addis Abbaba, longitude of, 507
Addu, Maldive islands, 281
Adler, B., Die neuesten russischen Seenforschungen in Westsibirien, 397 †
Admiralty Charts, 117 †, 415 †, 666 †
Admiralty Surveys during 1901, summary of, 742
Adriani, Dr. N., Mededeelingen omtrent de Toradja's van Midden Celebes, 397 †
Adriatic Sea—
  Seeboden - Relief des Adriatischen Meeres, von Prof. J. Luksch, 103 †
Afghanistan—
  Maps: Politisch - militärische Karte von Afghanistan, Persia, etc., von P. Langhans, 114 †
Africa—
  Abgrenzung unserer afrikanischen Schutzgebiete, von H. Singer, 528 †
  African Society and its Journal, 85
  African Subjects of Special Interest, Notes on, by Sir H. H. Johnston, 398 †
Africa—*continued.*
  African Wastes Reclaimed, by R. Young, 771 †
  Afrika, Zweite Auflage, von Dr. W. Sievers und Dr. F. Hahn, 771 †
  Belgischen Eisenbahn - Projekte am oberen Kongo und die deutsch-ostafrikanische Seenbahn, von E. Vohsen, 232 †
  British Central: Photographs of, by P. Weatherley, 119 †; Trade and General Condition of (Foreign Office Rep.), 526 †
  British East: The Foundation of, by J. W. Gregory, 526 †
  British West: The Rise of, by C. George, 771 †
  Central: Geological Notes from Tanganyika Northwards, by M. Fergusson, 232 †
  East: Heutige und einstige Vergletscherung im tropischen Ost-Afrika, von Prof. Dr. Hans Meyer, 399 †; Lebende und jungfossile Korallenriffe in Ost-Afrika, von Dr. E. Werth, 527 †; Mitteilungen über meine Reise nach Äquatorial - Ost - Afrika und Uganda, von Dr. Max Schoeller, 398 †; Ost- und Süd-Afrika, von M. Schanz, 527 †; Petrographische Ausbeute der Schöller'schen Expedition in Aequatorial - Ost - afrika, von E. Künzli, 232 †; Report . . . on the East Africa Protectorate, 526 †; Riftvalley systems of, 639; Schirehochlandbahn und die Afrikanischen Seengebiete, 527 †; Schilderungen der Suaheli von Expeditionen v. Wissmanns, Dr. Bumillers Graf von Götzens und Anderer, von Dr. C. Velten, 398 †
  East Central, Travel and Trade Routes in North-Eastern Rhodesia and Adjacent Parts of, 598
  Français en Afrique au XIX^e^ Siècle, par C. Simond, 398 †
  German East: Grabenländer im Nördlichen Deutsch-Ost-Afrika, von Dr. E. Kohlschütter, 528 †; Kartographischen und geophysischen Arbeiten der Pendel-Expedition . . . in Deutsch-Ost-Afrika, von Dr. E.

Africa—*continued.*
Kohlschütter, 656†; note on, 639; Magila in Picture, 399†; Reisebericht des Hauptmanns Charisius, 528†; Verkehrsverhältnisse in Deutsch-Ostafrika, von G. A. Kannengiesser, 656†; Von Utengule nach Kipembabwe . . . Inyika und zurück, von T. Meyer, 233†; Volkstämme der deutschen Ostküste des Victoria-Nyansa, von Hauptmann Schlobach, 233†
German Methods of Development in, by C. T. H. Wright, 399†
German Protectorates, Trade of the, by Dr. A. Zimmerman, 656†
German South-West: Deutsch-Südwest-Afrika im Vergleich zum übrigen Süd-Afrika, von Dr. A. Schenck, 656†; Reise von Grootfontein nach dem Okavango, 656†; Reiseerinnerungen aus dem, von E. Düttmann, 107†; Swakopmund einst und jetzt, von Dr. K. Dove, 233†
Kikamba Language, Vocabulary of the, by S. Watt, 655†
Main-d'Œuvre en Afrique, par A. d'Almada Negreiros, 398†
Maps: Africa a Base Fisica, by Prof. G. Cora, 245†; Africa (Intelligence Division, War Office), 664†, 786†; Carte d'Afrique (Service Géo. de l'Armée), 665†; Carte du Théatre de la Guerre Sud Africaine, par Colonel C. Favre, 536†; Special Map of South Africa, by W. and A. K. Johnston, 536†; Stuhlmann's Aufnahmen im Gebiet des Albert- und Albert-Edward-Sees, während der Emin Pascha-Expedition, von Max Moisel, 536†, 771†; West African Gold Mines (The Chartographic Company), 115†
Marchand Expedition, Positions fixed by the, Lieut. A. H. Dyé on, 505
Mission Marchand au point de vue médical, par J. Servigny, 398†
North: Moslem Confraternities of, by W. B. Harris, 108†
North-East: Baron Erlanger's Expedition in, 87; Landwirtschaftlichen Zustände im afrikanischen Osthorn, von Prof. Dr. C. Keller, 657†
Portuguese East: Expedition from Port Amelia to Lake Nyassa, commanded by Major Spilsbury, 400†; Un potentat africain, Goungounyane et son règne, par Dr. Liengme, 108†
Positions géographiques déterminées astronomiquement en Afrique Centrale au cours de la Mission Marchand, par A. H. Dyé, 655†; note on, 505
Protectorates of Great Britain in Tropical Africa, by Sir H. H. Johnston, 655†
South: Geodetic Survey of, 90; Native
Africa—*continued.*
Question in, by Hon. L. Zietsman, 108†; The First British Settlers in, by Rev. Dr. Wirgman, 108†; Ost- und Süd-Afrika, von M. Schanz, 527†; Indigènes de l'Afrique du Sud, Les Vaalpens, par Y. Guyot, 772†; Century of Exploration in, by G. Lacy, 772†; Ophir and Punt in, by Dr. Karl Peters, 773†; "Post-Office" Stone in the South African Museum, Notes on the, by W. L. Sclater, 773†
Surveys in, 376
Topographical Survey of, 398†
West: Glimpses of Native Law in, by Colonel Stopford, 400†; British Trade with, by J. W. Root, 400†; Westafrikanische Bantuneger, Seine Charakteristik und Behandlung, von D. Hutter, 658†; Gold-producing Region of, by S. J. Speak, 658†; Sherbro and its Hinterland, by T. J. Alldridge, 108†, Review of, 199; The West African Climate, 108†; Gold-producing Region of, by S. J. Speak, 773†; Afrikanisches Steingeld, von H. Schurtz, 773†; Plants collected by Dr. F. Welwitsch, Catalogue of, by W. P. Hiern, 773†; Samuel Braun aus Basel der erste deutsche wissenschaftliche Afrikareisende, von Dr. G. Henning, 773†
Zoo-geographischen Regionen auf dem Kontinent Afrika, Ueber die Entstehung der, von Prof. H. J. Kolbe, 654†
Agassiz, Prof., Expedition to the Maldives, 480
Agostini, Dr. G. de, Bathometrie der Italienischen Seen, 394†
Agriculture—
Évolution de l'agriculture, par H. Hitier, 533†
Ursprungsgebiet und Entstehungsweise des Ackerbaues, von Dr. E. Hahn, 782†
Ainsworth, Mr., report on Ukamba, 216
Ainu and their Folk-Lore, by Rev. J. Batchelor, 653†
Aix, Isle of—
Carte-plan de l'île d'Aix dressée par Cornuau, en 1672, présentée avec une note explicative, par M. Pawlowski, 393†
Akobo river, Sobat region, 385, 671, 672
Alaska—
Alaska, par F. Pasteyns, 773†
Alasko-Canadian Frontier, by T. W. Balch, 773†
Bering and Chirikof's voyages on the coast of, 756, 774*
Copper River of, by G. Davidson, 773†
Explorations, Recent, in, 609
Photographs of Alaska and British Columbia, by W. H. Cook, 538†; of Alaska and Herschel Island, by M. Marsden, 788†

Alaska—*continued.*
Touring Alaska and the Yellowstone, by C. M. Taylor, 108 †
Willows of, by F. Coville, 108 †
Albany Settlement, by J. B. Firth, 106 †
Albert Edward Nyanza, mountain range west of, 22
Albrecht, Dr. T., Die Veränderlichkeit der geographischen Breiten, 406 †
Algeria—
Alger au Congo par le Tchad, De l', par F. Foureau, review of, 196
Artesian water-supply of, 563
Algerian Sahara—
Photographs of the, by W. J. H. King, 538 †
Allan, A. C., obituary of, 225
Alldridge, T. J., The Sherbro and its Hinterland, 108 †; review of, 199
Almásy, Dr. G. v., Reise nach West-Turkestan und in den Centralen Tiën-Shan, 395 †
Alps—
Alpen im Eiszeitalter, von Dr. A. Penck und Dr. E. Brückner, 391 †
Catena della Levanna, by W. A. B. Coolidge, 391 †
Eiszeitforschung in den Alpen, Einige neuere Ergebnisse der, von Dr. A. Penck, 648 †
In 1864, by A. W. Moore, edited by A. B. W. Kennedy, 765 †
Österreichischen Alpenländer und die Grundkartenfrage, Historische Atlas der, von Dr. C. Giannoni, 103 †
Problème Alpin, par A. de Lapparent, 765 †
Uebertiefung der Alpen-Thäler, von Dr. A. Penck, 391 †
Vallées des Alpes occidentales, Recherches sur l'origine des, par M. Lugeon, 648 †; note on, 210
Altai—
Russian explorations in the, 578–580, 597
Sketch of Immigration to the Altai District, 231 †
Telezkoie Lake in the Altai, Ignatov's expedition to, 370
Alterklassen und Männerbünde, von H. Schurtz, 781 †
Alukthang glaciers, Kangchenjunga, 457
Amaral, F. J. Ferreira do, A Luciano Cordeiro, 782 †
Amarillo branch of the Sucio, 319
Amazon—
Reise des amerikanischen Kanonenbootes Wilmington auf dem Amazonenstrom, von Z. D. Todd, 109 †
Amboina—
Geologie van Ambon, Over de, door R. D. M. Verbeek, 525 †
Amdrup, Lieut., award to, 630, 648; Die Dänischen Expedition nach Ost-Grönland, 779 †
America—
Birds of North and Middle America, by R. Ridgway, 774 †
America—*continued.*
Discovery of: Die Kunde der Entdeckung Amerikas im deutsch-slavischen Osten, von Dr. O. Schwarzer, 240 †
Entdeckungen der Normannen in Amerika, von J. Fischer, 658 †
Interoceanic Communication on the Western Continent, by Colonel G. E. Church, 313 *
Maps of America in the Library of Congress, A List of, by P. Lee Phillips, 401 †
Name of: Älteste Karte mit dem Namen "America" . . . des Martin Waldseemüller, von Dr. F. R. v. Wieser, 661 †; First Map containing the Name America, by B. H. Soulsby, 201 *; Per la storia del nome "America," del Prof. P. L. Rambaldi, 109 †
Normannen in Amerika, Die Entdeckungen der, von J. Fischer, review of, 746
America, Central—
Expedition nach Central- und Südamerika, von Dr. P. Preuss, 236 †
Geographische Forschung in Mittel-Amerika im 19. Jahrhundert, von Dr. Karl Sapper, 659 †
Isthmian Canal, The Latest Route proposed for the, 775 †
Mittelamerikanische Reisen und Studien, von Dr. K. Sapper, 775 †
Stanford's Compendium of Geography and Travel, Central America and the West Indies, by A. H. Keane, 530 †; review of, by Colonel G. E. Church, 622
America, North—
Descriptive Geographies from Original Sources, selected by F. D. Herbertson, 401 †
Early Trading Companies of New France, by H. P. Biggar, 235 †
Ethnology, Annual Report of the Bureau of, by J. W. Powell, 401 †
Lakes of, Biological Station on the, 756
Land and Sea Mammals of North America north of Mexico, A List of, by D. G. Elliot, 529 †
North-West Coast of, Voyages of Bering and Chirikof on the, Prof. G. Davidson on the, 756, 774 †
America, South—
Maps: Geographische Verbreitung der hauptsächlichsten Eruptionszentren, etc., von A. Stübel, 537 †; America Sud a Base Fisica, by Prof. G. Cora, 247 †
Palmen-Flora Südamerikas, Beiträge zur, von C. A. M. Lindman, 530 †
Amherst of Hackney, Lord, and Basil Thomson, The Discovery of the Solomon Island, edited by, 778 †
Ami, H. M., Synopsis of the Geology of Canada, 529 †
Amu Darya, The Upper, by N. Bogoyavlensky, 106 †

Amundsen, Captain R., A proposed Expedition to the North Magnetic Pole, 484; En paatoenkt Undersøgelsesreise til den magnetiske Nordpol, 779 †
Anderson, T., The Coupe de Jaujac, 392 †
Anderson, W., First Report of the Geological Survey of Natal and Zululand, 772 †
Andersson, Dr. J. G., Ett Bidrag till Ostersjöns djurgeografi, 765 †; Zur Pflanzengeographie der Arktis, 779 †
Andes—
Maps: Sixteen Maps of the Cordillera de los Andes (Argentine Boundary Commission), 413 †
Andorobo tribe, Uganda Protectorate, 7
Andrews, A. W., Lecture to Teachers on the Use of Maps, 383; The Use of Maps in Geography Teaching, 241 †
Angola—
Colonies Portugaises: Angola, par A. d'Almada Negreiros, 526 †
Haute-Cimbébasie, À travers la, par R. P. E. Lecomte, 526 †
Idéas geraes sobre a colonizaçao europeia da provincia de Angola, Pelo Visconde de Giraúl, 771 †
Map of (Revista Portugal em Africa), 665 †
Portuguese Congo, Itineraries in, by Rev. T. Lewis, 526 †
Strange Adventures of Andrew Battell of Leigh in Angola, edited by E. G. Ravenstein, 772 †; review of, 745
Angoniland plateau, 603
Anguilla, St. Martin, etc., On the Geological and Physical Development of, by Prof. J. W. W. Spencer, 235 †
Ankole, Uganda Protectorate, 24
Annam—
Maps: Carte de l'Annam (Service Géo. de l'Indo-Chine), 114 †
Mines d'or de Bong-Miu (Annam), par L. de Saugy, 230 †
Pays d'Annam, par P. d'Enjoy, 230 †
Régime économique de la Côte d'Annam, par P. de Barthélemy, 524 †
Année Cartographique, par F. Schrader, 414 †
Annuaire pour l'an 1902, publié par le Bureau des Longitudes, 663 †
Antanosy: *see* Madagascar.
Antarctic—
Arctic and Antarctic, by W. S. Bruce, 532 †
Auf zum Südpol! von Prof. Dr. G. von Neumayer, 238 †; review, 362
Aurores australes observées à bord de la "Belgica," Sur les variations périodiques des, par H. Arctowski, 404 †
Belgian Expedition: Expédition Antarctique Belge. Résultats du Voyage du S.Y. "Belgica," par H. Arctowski et J. Thoulet, 404 †, 778 †; letter from M. J. Leclercq on the, 519; letter from H. Arctowski on, 388; letter from Paul Pelseneer on the, 387; Quelques résultats de l'xpédition antarctique belge, par M. Zimmermann, 531 †; Voyage de la *Belgica*, par Commandant de Gerlache, 778 †
Climate: Antarktische Klima, von Prof. Dr. A. Supan, 660 †
Exploration, by Prof. J. W. Gregory, 660 †
Geologischen Probleme der Antarktis, von Dr. E. Philippi, 660 †
German Expedition, 222, 641; progress of the, 97; Erster Bericht des Leiters der Deutschen Südpolar-Expedition, 531 †; Deutsche Südpolar-Expedition, von O. Baschin, 660 †; Von der Deutschen Südpolar-Expedition, von E. von Drygalski, 404 †, 531 †, 660 †, 778 †; Zweiter Thätigkeitsbericht der Deutschen Kommission für die Südpolar-Forschung, von Dr. G. von Neumayer, 660 †
National Expedition, 222, 435; arrival of the *Discovery* at Lyttelton, 97, 102; Final List of Officers and Crew of the *Discovery*, 448; relief ship for the, 446, 452, 764
Scottish National Antarctic Expedition, by W. S. Bruce, 404 †
Swedish Expedition, 761
Treibeis der antarktischen Meere, von Dr. K. Fricker, 404 †
Voyage Southward of the *Discovery*, papers by Dr. Mill, Mr. Murray, and Sir Clements Markham, 417 *
Anthropogeography—
Conditions géographiques des faits sociaux, par P. Vidal de la Blache, 781 †
Wirtschaftlichen Typen der Ansiedelungen, von A. Hettner, 781 †
Anthropology—
Anthropological Investigations in the Alps and Caucasus, by V. Dingelstedt, 533 †
Living Races of Mankind, by H. Hutchinson, J. W. Gregory, and R. Lydekker, 533 †
Antigua, On the Geological and Physical Development of, by Prof. J. W. W. Spencer, 235 †
Artze, G., Revision der Oberflächenströmungen des nordatlantischen Ozeans auf Grund der Triftphänomene, 111 †
Arabia—
Southern, Dr. Hein's expedition to, 370
Aral Sea—
Changes of Level of the, L. S. Berg on the Periodicity of, 503
Sketch of the Physical Geography of the, by L. S. Berg, 768 †
Arctic—
Andréeschen Polarexpedition, Wann erfolgte der Untergang der, von Dr. E. Voigt, 404 †
Arctic and Antarctic, by W. S. Bruce, 532 †

Arctic—*continued.*
Arctic Pilot, compiled by Vice-Admiral J. P. Maclear, 779 †
Crustacea collected during the Swedish Arctic Expeditions, 1898 and 1899, by A. Ohlin, 531 †
Drift Casks to determine Arctic Currents, by H. G. Bryant, 404 †
Ergebnissen der Polarfahrt des "Matador" unter Führung des Kapt.-Leut. Oskar Bauendahl. 238 †
Expeditions: Baron E. W. Toll's, 221, 510; Peary's, 96, 762
Farther North than Nansen, by H.R.H. the Duke of the Abruzzi, 779 †
Finding the Way to the Pole, 110 †
Magnetic Pole, Proposed expedition to the, 97; by Captain R. Amundsen, 484 *
Magnetiske Nordpol, En paatoenkt Undersøgelsesreise til den, by Kapt. R. Amundsen, 779 †
Meteorological and Hydrological Observations in 1898, by the expedition of Colonel Vilkitzky, 405 †
Nansen, La Spedizione Artica di, di G. Cora, 405 †
Nord-Polarmeer, Das, von R. Dittmer, 404 †
Norwegischen Polar-Expedition mit der *Fram*, Ergebnisse der meteorologischen Beobachtungen der, von Dr. H. Mohn, 405 †
People of the Farthest North, by F. A. Cook, 660 †
Pflanzengeographie der Afrika, von Dr. G. Andersson, 779 †
Russian Expedition under Captain Warneck, 762
Russian Polar Expedition in the *Sarya*, by Baron E. von Toll, 475 *
Treibeises in den arktischen Meeren, Dir Verbreitung des, von T. V. Garde, 405 †
Arctowski, H., A propos de la question du climat des temps glaciaires, 532 †; letter from, on the Belgian Antarctic Expedition, 388 †; Sur les variations périodiques des aurores australes observées à bord de la "Belgica," 404 †; et J. Thoulet, Expédition Antarctique Belge. Resultats du Voyage du S.Y. "Belgica." Océanographie, 404 †; Expédition Antarctique Belge, Rapports scientifiques, etc., 778 †
Ardaillon and Cayeux, MM., Scientific expedition in Crete, 212
Ardèche—
Coupe de Jaujac, The, by T. Anderson, 392 †
Argentine Republic—
Agricultura, Ministerio de. Memoria presentada al Honorable Congreso, 402 †
Boundary Dispute between Chile and Argentina, by Hope Gibson, 775 †
Colonizzazione della Repubblica Argentina, Sulla, por E. C. Gelodi, 402 †
Argentine Republic—*continued.*
Cruz en America (Arqueologia Argentina), by A. Quiroga, 402 †
Homenaje al Presidente Dr. Campos Salles. El Brasil y la Argentina, 109 †
Maps: Argentine Railways (Buenos Aires and Pacific Railway Co.), 115 †; Sixteen Maps of the Cordillera de los Andes (Argentine Boundary Commission), 413 †
Población probable de la República al entrar al siglo XX., Cálculo de la, por G. Carrasco, 402 †
Arid Regions, Characteristics of Soils in the, by E. W. Hilgard, 406 †
Arkansas Valley, Composite Genesis of the, by C. R. Keyes, 235 †
Armenia—
Armenien, Eine Kulturhistorische Studie, von Dr. H. Zimmerer, 768 †
Armenien im Altertum und in der Jetztzeit, von Dr. W. Belck, 106 †
Arnold, Dr. R., Vier Karten und Studien zur Wirthschafts-Geographie von Marokko, 107 †
Artesian Water-Supply of Australia from a Geographical Standpoint, by W. Gibbons Cox, 560 *
Aryans—
Ursprung der Arier in geographischen Licht, von Dr. F. Ratzel, 409 †
Ashanti—
Busumchwi Lake, Mr. M. Fergusson's account of, 370
Photographs of, by M. Fergusson, 538 †
Asia—
Central, Dr. Sven Hedin's journeys in, 85; Lieut. Kozloff's expedition, 85
Dreiunddreissig Jahre in Ost-Asien, von M. von Brandt, 231 †
Dritte Asiatische Forschungsreise des Grafen Eugen Zichy, 652 †
Eastern: L'Allemagne en Extrême-Orient, par A. Brissé, 396 †; L'atmosphère en Extrême-Orient pendant les six mois froids, par P. Pere A. Froc, 653 †; Européens dans l'Asie Orientale, par E. Guillot, 230 †; Structure and Divisions of the Coast of, Baron von Richthofen on the, 214
Eisenbahnen . . . in Klein- und Mittel-Asien, von Dr. Kürchhoff, 768 †
European Expansion in, by Major Younghusband, 651 †
Itinéraires à travers l'Asie, par M. Monnier, 651 †
Maps: Hölzel's Schulwandkarte von Asien, von Dr. F. Heiderich, 785 †
Pékin à la Mer Noire à travers l'Asie, De, par M. C.-E. Bonin, 395 †
Russian Central: Seespiegelschwankung zwischen Aralsee und Baraba und die Brücknersche Hypothese, von Prof. Dr. A. Woeikow, 397 †
Russland in Asien, Historisch-wirt-

Asia—*continued.*
schaftliche Skizze, von M. Meister, 525 † (*see* Asiatic Russia)
Western: Beiträge zur alten Geographie und Geschichte Vorderasiens, von Dr. W. Belck, 770 †; Divisione amministrativa dell' Impero dei Seleucidi, della dott. A. Corvatta, 232 †
Westward from the Golden Gate, by Annie Russell Cotes, 105 †
Asia Minor—
Geologische Studien im südöstlichen Kleinasien, von Dr. F. Schaffer, 654 †
Höhenlandschaften Kappadoziens, 770 †
Maps: Karte des nordwestlichen Kleinasien in vier Blättern, von W. v. Diest, 114 †; Karte von Kleinasien, von Dr. R. Kiepert, 245 †, 411 †, 786 †
Western, Dr. Philippson's journey in, 751
Asiatic Russia, altitudes in, Prince Kropotkin on, 634; Map of (Ministry of Ways and Communications), 114 †
Aspe-Fleurimont, M., Le Congo français, 399 †
Astronomy—
Method of predicting by Graphical Construction Occultations of Stars, etc., by F. C. Penrose, 779 †
Sun, Tables of the Corrected Azimuths of the, 110 †
Atlantic—
Oberflächenströmungen des nordatlantischen Ozeans aut Grund der Triftphänomene, von G. Antze, 111 †
Oceanographical Research in the, by Dr. H. R. Mill, 354 *
Pilot Charts of the (U.S. Hydrographic Office), 119 †, 248 †, 416 †, 538 †, 668 †; and the Mediterranean (Met. Office, London), 119 †, 248 †, 416 †, 538 †, 667 †, 787 †
Sturmtabellen für den Atlantischen Ozean, von E. Knipping, 111 †
Variations Annuelles de l'eau de surface de l'Océan Atlantique, par Cleve Ekman et Pettersson, 533 †
Atlantic Ferry, The, Louisburg and Milford Haven, 239 †
Atlases—
Année Cartographique, par F. Schrader, 414 †
Atlas des Colonies Françaises, par P. Pelet, 247 †
Foreign Mission Atlas, by Dr. G. Smith, 415 †
Formæ Orbis Antiqui, von R. Kiepert, 537 †
Historical Atlas of Modern Europe, by R. L. Poole, 411 †
International Student's Atlas of Modern Geography, by J. G. Bartholomew, 665 †
Linien gleichen Unterschiedes des wahren Luftdrucks in Januar und Juli, von R. Spitaler, 247 †
Neuer Volks- und Familien-Atlas in einhundert Kartenseiten, von A. Scobel, 247 †
Stieler's Hand-Atlas, Neue, neunte Lieferungs-Ausgabe von, 116 †, 247 †, 537 †, 666 †, 787 †
Victoria Regina Atlas, by W. & A. K. Johnston, 116 †
Atmosphere, General Circulation of the, by H. H. Kimball, 780 †
Atna river, Alaska, 610
Aty-bogdo and Koku-tomyrty mountains, Gobi desert, 582
Aulagnon, C., La Sibérie Economique, 769 †
Aurich—
Volksverdichtung im Regierungsbezirk Aurich, von Dr. O. Thiele, 393 †
Auroras (*see also* Antarctic)—
Démonstration géographique de l'origine terrestre des aurores polaires, Note de M. H. Stassano, 111 †
Influence des basses pressions barométriques sur la fréquence des aurores polaires, par H. Stassano, 780 †
Austin, Major H. H, Identification of Wellby's river and the Gelo, 520; letter from, on the Hydrography of the Sobat Region, 385; A Journey from Omdurman to Mombasa *viâ* Lake Rudolf, 669 *
Austin, O. P., Colonial Administration, 782 †
Australia—
Artesian Water-supply of Australia from a Geographical Standpoint, by W. Gibbons Cox, 560 *
Australien und Südseefahrt von Dr. A. Daiber, 776 †
Capital: Report of the Commissioner on Sites for the Seat of Government of the Commonwealth, 403 †; Lake George as a Site for the Federal Capital of Australia, by F. B. Gipps, 403 †
Climate and Artesian Waters of, by J. P. Thomson, 659 †
Commercial Australia in 1900..659 †
Constitution of the Commonwealth of, by Harrison Moore, 659 †
Discovery of: Was Australia discovered by De Quiros in the year 1606? by Cardinal Moran, 530 †; note on, 377; De Quiros and the Discovery of Australia, by A. Sutherland, 530 †; Did De Quiros land at Port Curtis? by G. Gordon, 530 †
Eyre, Lake, Prof. Gregory's expedition to, 377, 509, 607
Federal Weather Bureau, Suggestions for the Establishment of a, by C. L. Wragge, 403 †
Glimpses of Australian Exploration, by Rev. J. Bryant, 237 †
Geographical Evolution of the Australian Continent, by J. P. Thomson, 236 †

Australia—*continued.*
Intercolonial Water Rights, Mr. H. McKinney on, 760
Lady Nelson, H.M.S., by Captain W. C. Thomson, 530 †
Maps: Topographical Map of Kalgoorlie, by W. D. Campbell and the late S. J. Becher, 665 †
Snowy Ranges of, by C. Wragge, 237 †
South: Agricultural Capabilities of the Northern Territory of, Mr. M. W. Holtze on, 378; Northern Territory of, by Hon. J. L. Parsons and M. W. Holtze, 404 †; Notes on Glacial Beds of Cambrian Age in, by C. Chewings, 237 †; Preliminary Note on the Existence of Glacial Beds of Cambrian Age in, by W. Howchin, 237 †; Notes on the Extinct Volcanoes of Mounts Gambier and Schank, by W. Howchin, 238 †; Ethnological Notes on the Aboriginal Tribes of, by R. H. Mathews, 238 †; Memorial to Captain Flinders, 759; Exploration in, by Mr. R. T. Maurice and W. R. Murray, 760
Studienreise nach Australien, Ergebnisse einer wirtschaftgeographischen, von Dr. Max Wiedemann, 403 †
Water Rights, Intercolonial, as affected by Federation, by H. G. McKinney, 403 †
Water Supply of, by W. G. Cox, 530 †
West: Across the Westralian Desert, by A. Macdonald, 778 †; Crown Lands of, the Land Selections' Guide to the, 778 †; Western Australia and its Resources, 778 †; Minerals in, 378; Notes of a visit to, by W. D. Le Souëf, 659 †
Austria—
Karren und Dolinen im Riffkalk der Uebergossenen Alm, von Prof. H. Crammer, 765 †
Tägliche periodische Schwankung des Erdbodens . . . zu Triest, von E. Mazelle, 391 †
Austria-Hungary—
Kanäle und Kanalprojekte in Oesterreich-Ungarn, von Prof. Dr. R. Sieger, 391 †
Maps: Eisenbahn- u. Postkarte von Oesterreich-Ungarn, Artaria & Co., 243 †
Avebury, Lord, The Scenery of England, etc., 767 †
Avelot, Lieut., Dans la boucle de l'Ogôoué, 233 †
Ayes, W. O., Philip's practical "Index" Guide to London, 229 †
Aymonier, E., Le Cambodge, 395 †
Azerbaijan, Trade of (Foreign Office Rep.), 106 †
Azores—
Histoire de la découverte des îles Açores, par J. Mees, 655 †
Azores—*continued.*
Valentin Ferdinands Beschreibung der Azoren, von S. Ruge, 771 †

B.

Bache, A., Peat Fuel in Scandinavia, 395 †
Baddeley, M. J. B., Thorough Guide Series, Bath and Bristol and Forty Miles Round, 767 †; Yorkshire, 104 †
Baedeker, Karl, Handbook for Travellers, Egypt, 399 †; Southern Supremo, 649 †; Russland, Handbuch für Reisende, 228 †
Baffinland—
Photographs of, by Dr. R. Bell, 119 †
Baganda tribe, 21
Baghdad, Trade of (Foreign Office Rep.), 106 †
Bahamas—
Photographs of the, by Messrs. Cooney, Davenport, and Mancel, 539 †
Report for 1900 (Colonial Rep.), 235 †
Ba-hima tribe, Uganda Protectorate, 25
Bahr-el-Ghazal—
Congo State and the, by E. P. Morel, 232 †
Baikal, Lake, Chart of the Southern Portion of (Russian Gov.), 245 †; Expedition to, under Colonel Drizhenko, 754
Baker, Marcus, The Lost Boundary of Texas, 529 †
Ba-konjo, Ba-nande, and Ba-amba tribes, 38, 39
Balch, E. S., Evaporation Underground, 780 †
Balch, T. W., The Alasko-Canadian Frontier, 773 †
Baldacci, Dr. R., Un' escursione archeologica del dott. R. Paribeni nel Montenegro, 391 †
Balkan Peninsula—
Structure of the, Prof. Cvijić on the, by Dr. Karl Peucker, 735
Ball, John, Kharga Oasis: its Topography and Geology, 527 †
Ballay, Dr., obituary of, 646
Ballesteros, S. L., La Provincia de Caupolicán y el Decreto Supremo sobre la creación del Territorio Nacional de Colonias, 236 †
Ballooning—
Aéronatique maritime: la traversée du "Mediterranean," par Cte. Henry de la Vaulx, 534 †
Phénomènes physiques et chimiques de la respiration à différentes altitudes, pendant une ascension en ballon, par MM. Tissot et Hallion, 534 †
Ballore, F. de Montessus de, Les tremblements de terre de plissement dans l'Erzgebirge, 649 †
Baltic—
German Hydrographical Research in the, 83

Baltic—*continued.*
Instructions for Sailing from Kronstadt to Vladivostok and return, 765 †
Mittelwasser der Ostsee, von Dr. A. Westphal, 407 †
Ostersjöns djurgeografi, Ett bidrag till, af J. G. Andersson, 765 †
Baluchistan—
Geological Sketch of the Baluchistan Desert, and part of Eastern Persia, by E. Vredenburg, 395 †
North-West, Mr. E. Vredenburg's description of, 632
Bam, Persia, 138
Bangkok, Trade of the Consular District of (Foreign Office Rep.), 106 †
Bantu tribes and language, 16
Barabra, Les, par E. Chantre, 772 †
Baratta, M., A proposito dei "Mistpoeffers" italiani, 650 †
Baring-Gould, S., A Book of Brittany, 227 †
Baringo, Lake, Uganda Protectorate, 8
Barnes, Mr., remarks on the "Teaching of Geography," 82
Barrère, H., Europe, Map of, 411 †
Barron, A., Report of the Department of Lands and Survey, New Zealand, 531 †; note on, 221
Barthélemy, Cte. P. de, Le régime économique de la Côte d'Annam, 524 †
Bartholomew, J. G., Cyclists' Road Map of the Leeds, Bradford and York District, 785 †; The International Student's Atlas of Modern Geography, 665 †; The Philosophy of Map-making, etc., 660 †; Plan of Liverpool, 114 †; Reduced Ordnance Survey of England and Wales, 535 †, 664 †; Reduced Ordnance Survey of Windermere and Morecambe bay, 535 †
Baschin, O., Bibliotheca Geographica, 662 †; Die Deutsche Südpolar-Expedition, 660 †
Bashákird, plain of, Baluchistan, 131
Bashmakov, A. A., A Journey in Macedonia, 104 †
Batchelor, Rev. J., The Ainu and their Folk-lore, 653 †
Bath and Bristol and Forty Miles Round, Thorough Guide Series, by M. J. B. Baddeley, 767 †
Batoum and District, Trade of (Foreign Office Rep.), 231 †
Batsevich: *see* Ivanoff.
Batz, Baron de, Voyage en Mongolie, 396 †
Baudoinville, Lake Tanganyika, 599
Bauendahl, Kapt.-Leut. Oskar, Aus den wissenschaftlichen Ergebnissen der Polarfahrt des "Matador" unter Führung des, 238 †
Bauer, L. A., Note on the Secular Motion of the Earth's Mean Magnetic Axis, 112 †
Beadnell, H. J. L., The Fayûm Depression, 399 †; Découvertes géologiques récentes dans la vallée du Nil et le désert Libyen, 655 †
Bear Island—
Fauna der Bären-Insel, Beiträge zur, von G. Swenander, 531 †
Flora der Bären-Insel, Beiträge zur, von A. Cleve, 531 †
Beaujolais—
Conditions géographiques de la vie animale dans le, par P. Privat-Deschanel, 392 †; Relief du, par P. Privat-Deschanel, 649 †
Beaumont, G. de, Les grands Domaines franco-tunisiens, 400 †
Beazley, C. R., The Dawn of Modern Geography, 240 †, review of, by E. J. Payne, 498
Beccari, O., Nelle Foreste di Borneo, 525 †
Becher: *see* Campbell
Beekman, A. A., Nomina Geographica Neerlandica uit een geographisch oogpunt beschouwd, 650 †
Beira, Trade of (Foreign Office Rep.), 233 †
Bel, J. M., En Indo-Chine, du Sous-Sol, 524 †
Belam, H., and H. G. G. Ashton, Chart of Liverpool Bay, 244 †
Belck, Dr. W., Armenien in Altertum und in der Jetztzeit, 106 †; Beiträge zur alten Geographie und Geschichte Vorderasiens, 710 †
Belgian Colonies—
Charte coloniale de la Belgique, 241 †
Bell, J. Macintosh, Photographs of the Great Bear Lake Region, 119 †
Bell, Dr. R., Photographs of Baffinland, 119 †
Bengal, Malaria Investigations in, by Messrs. Stephens and Christophers, 753
Beni-Moskin, Itinéraire de Casablanca aux, par Dr. F. Weissgerber, 400 †
Benin—
Handelsbeziehungen von Benin, Ueber die alten, von Prof. Dr. F. von Luschan, 400 †
Karl Knorrsche Sammlung von Benin-Altertümern, von F. V. Luschan, 233 †
Bereimi, oasis of, Oman, 62
Berg, A., Georg Torquatus als ältester Halberstädter Topograph, 534 †
Berg, L. S., on the Periodicity of changes of level in the Aral Sea, 503; Sketch of the Physical Geography of the Aral Sea, 768 †
Bering and Chirikof, Voyages of, on the North-West Coast of America, Prof. G. Davidson on, 756, 774 †
Bering Strait—
Maps: Goldgebiete zu beiden Seiten der Beringstrasse, von Hauptmann H. Immanuel, 787 †
Berkshire—
Gravel-Flats of Surrey and, On the Origin of the, by H. W. Monckton, 229 †

Berlin Geographical Society, "Zeitschrift" of the, 383
Bermuda and the *Challenger* Expedition, by G. W. Cole, 658 †
Berthelot, A., Sur les origines de la source de la Loue, 227 †
Bertrand, L., Sur la tectonique des environs de Biarritz, 649 †
Best, E., Te Whanga-Nui A-Tara, 531 †
Bezerra, A., Algumas origens de Ceará, 236 †
Bhamo, From Shanghai to, by R. Logan Jack, 249 *
Biarritz, Bidart et Villefranque, Sur la tectonique des environs de, par L. Bertrand, 649 †
Bibliography, New Colonial, 762
Bibliotheca Geographica, von O. Baschin, 662 †
Biddle, A. J. Drexel, The Land of the Wine, being an account of the Madeira Islands, 107 †
Bidou, H., L'Achèvement du Transsibérien, 770 †
Bigelow, P., Colonial Administration in different parts of the World, 241
Biggar, H. P., The Early Trading Companies of New France, 235 †; review of, 745
Bigourdan, G., Sur la mesure de la méridienne de France, par Méchain, à la fin du XVIII^e^ siècle, 649 †
Biography—
Diccionario Biográfico de Estranjeros en Chile, par P. P. Figueroa, 240 †
Dictionary of National Biography, edited by Sidney Lee, 240 †
Biological Station on the Great American Lakes, 756
Bird, C., Limitations and Possibilities of Geographical Teaching in Day Schools, 112 †
Birjand, Persia, 150
Bishop, Isabella L., Notes on Morocco, 107 †
Bismarck-Archipelago—
Ortsnamen im Bismarck-Archipel, von Dr. Schnee, 530 †
Samoa, Bismarckarchipel und Neuguinea, von E. von Hesse-Wartegg, 778 †
Black, W. T., The Fish River Bush, South Africa, 655 †
Blanford, Dr. W. T., The Distribution of Vertebrate Animals in India, Ceylon, and Burma, 524 †; note on, 633; remarks on "The Formation of the Maldives," 298; remarks on the "Glaciers of Kangchenjunga," 474
Bludau, Dr. A., Was gehört aus der Projektionslehre auf die Schule? 662 †
Blue river, Tibet, 592
Blume, F., Ajuste de los Instrumentos de nivelar, 532 †
Boas, Prof. Dr. F., The Jesup North Pacific Expedition, 408 †, 409 †
Bodsohn, P. L., Reise im unabhängigen Sikkim, 396 †
Bœufvé, E., Le port de Bremerhaven, 393 †
Bogoyavlensky, N., The Upper Amu Darya, 106 †
Bohemia—
Deutsche Sprachgebiet in Süd- und Ostböhmen, von Dr. J. Zemmrich, 391 †
Bohio dam of the Panama Canal, 329
Böhm, Dr. A., Geschichte der Moränenkunde, 532 †
Bolivia—
Bolivianische Territorium Acre und Seine Revolution, 235 †
Boundary between Brazil and, 220
Censo Nacional de la Población de la República, 659 †
Colonias, La Provincia de Caupolicán y el Decreto Supremo sobre la creación del Territorio Nacional de, por S. L. Ballesteros, 236 †
Cuestión de Límites con el Brasil, by J. L. Muñoz, 659 †
Diccionario Geográfico de la, Departmento de Cochamba, por F. Blanco, 775 †
Distrito minero de plata de Potosi, Bolivia, por A. F. Wendt, 658 †
Limites entre Bolivia y el Paraguay, La Cuestión de, por Dr. A. Quijarro, 529 †
Northern Bolivia and President Pando's New Map, by Colonel G. E. Church, 109 †
Rio de la Plata Route, Bolivia by the, by Colonel G. E. Church, 64 *
Bolland, Captain Enrique, Exploraciones practicadas en el Alto Paraguay y en la Laguna Gaiba, 110 †; surveys in Bolivia, 64
Bolvanskaya bay, Pechora region, 369
Boma district, East Central Africa, 673
Bonar, H. A., From Japan to Europe by the Trans-Siberian Route, 770 †
Bonin, C.-E., De Pékin à la Mer Noire à travers l'Asie, 395 †
Bonnard, P., A propos du Transsaharien, 400 †
Bonnevie, Captain, obituary of, 516
Bonsdorff, A., Om landhöjningen vid Rusterna af Östersjön och Kattegat, 650 †
Boothia, magnetic pole on, 488
Bordier, Commandant D., La Tunisie en 1900..108 †
Borneo—
Foreste di Borneo, Nelle, by O. Beccari, 525 †
Head-Hunters, Black, White, and Brown, by A. C. Haddon, 654 †
Mededeelingen over het vervolg der commissiereis naar Centraal-Borneo, door Dr. A. W. Nieuwenhuis, 397 †
Natives, Immigrants and European Enterprises, by the Ven. A. F. Sharp, 231 †
Borodovsky, S. C., Map of Manchuria, 115 †

Bory de Saint-Vincent, Deux lettres de, par F. Donnet, 662 †
Bos, Lieut., Exploration in the Northern Ubangi Basin, 89
Bosnia—
Bosnie et l'Herzégovine, par Dr. J. Kòsćak, 391 †
Neue Eiszeitspuren aus Bosnien und der Herzegowina, von Dr. A. Grund, 765 †
Vergletscherung der Vratnica planina in Bosnien, von Dr. F. Katzer, 391 †
Boston Mountains, Arkansas, Physiography of the, by A. H. Purdue, 774 †
Boulenger, G. A., Report on the Collection of Fishes made by Mr. Moore . . . in 1899-1900 .. 234 †
Bourdariat, A. J., Carte de la Côte d'Ivoire, 413 †
Bradford, Leeds, and York District, Cyclists' Road-Map of the, by J. Bartholomew, 785 †
Bradley, A. C., Highways and Byways in the Lake District, 104 †
Brahmaputra Valley, The Tribes of the, by L. A. Waddell, 396 †
Brandenburg—
Regenkarte der Provinzen Brandenburg und Pommern, von Prof. Dr. G. Hellmann, 393 †; note on, 501
Brandt, M. von, Dreiunddreissig Jahre in Ost-Asien, 231 †
Branner, Prof. J. C., The Origin of Travertine Falls and Reefs, 111 †; The Palm Trees of Brazil, 659 †
Brazil—
Books, etc., relating to, A List of, prepared by P. Lee Phillips, 109 †
Botokuden, Die erste ethnographische Skizze über die, von F. Schulze, 109 †
Boundary between Bolivia and, 220
Cuestión de Límites con el Brasil, by J. L. Muñoz, 659 †
Guapore, L'exploitation du haut, 402 †
Homenaje al Presidente Dr. Campos Salles. El Brasil y la Argentina, 109 †
Italiani nel Nord dello Stato di Santa Caterina, del G. Pio, 236 †
Klima von Juiz de Fora im Staate Minas-Geraes, von Prof. F. M. Draenert, 775 †
Linea geodésica Madera-Yavary, por E. Idiaquez, 659 †
Maps: Karte von Südbrasilien, von Dr. R. Jannasch, 115 †; Mappa Geographico do Estado do Amazonas, por E. Stradelli, 246 †
Palm Trees of, by Prof. J. C. Branner, 659 †
São-Paulo-Ribeira-Bahn, Die, 402 †
Uberaba, Central-Brasilien, Das Höhenklima von, von Prof. F. M. Draenert, 109 †
Bredebugt bay, Iceland, 613
Bremerhaven, Le port de, par E. Bœufvé, 393 †
Breslaus Stellung im Schnellverkehr, von Marie Krauske, 227 †
Bretherton, Major, exploration of route from the Indus to the Kashmir valley, 631
Brice, A. M., The Great Siberian Railroad, 231 †
Bright, Major, remarks on a "Journey from Omdurman to Mombasa," 688
Brisbane River—
Land Floods in a Tidal River, On Some Effects of, by C. J. R. Williams, 404 †
Mitigation of Floods in the, On the, by Hon. A. C. Gregory, 237 †
Brissé, A., L'Allemagne en Extrême-Orient, 396 †
Britannia, S.S., deep-sea deposits, samples collected by, 699
British Association, Glasgow, 1901, Report of the, 782 †
British Columbia—
British Columbia of To-day, by Hon. J. H. Turner, 773 †
Mountain Travel and Climbs in, by H. E. M. Stutfield, 528 †
Photographs of Alaska and, by W. H. Cook, 538 †
Year Book of, 528 †
British Empire—
British Empire Series. Vol. 5, General, 662 †
Harmony of the Empire, 534 †
Wachstum Englands, von Dr. J. Heiderich, 662 †
British Isles, Britain, Great Britain: *see* United Kingdom
Brittany—
Book of, by S. Baring-Gould, 227 †
Brodrick, M., and A. A. Morton, A Concise Dictionary of Egyptian Archæology, 527 †
Brousseau, G., Les Richesses de la Guyane Française et de l'ancien Contesté Franco-Brésilien, 236 †
Brown, A. Samler, Madeira and the Canary Islands, with the Azores, 107 †
Brownlie, A., The Solution of the Problem of the Tidal Bore, 408 †
Bruce, W. S., Arctic and Antarctic, 532 †; (Biography of) Prof. Baron A. E. von Nordenskjöld, 409 †; The Scottish National Antarctic Expedition, 404 †
Bruchhausen, Major Karl von, Eine deutsche Kohlenstation im Roten Meere, 106 †; Abessinien als Goldland, 771 †
Brückner: *see* Penck
Brunel: *see* Mourey
Bryant, H. C., Drift Casks to determine Arctic Currents, 404 †
Bryant, Rev. J., Glimpses of Australian Exploration, 237 †
Bryce, Right Hon. James, The Importance of Geography in Education, 301 *; review of George's "Relations of Geography and History," 627
Buchanan, J. Y., Chemical and Physical Notes, 111 †

Buenos Ayres—
Geologia de la Provincia de Buenos Aires, Contribuciones al Conocimiento de la, por R. Hauthal, 402 †
Buhle, H., Das Deutschtum in Guatemala, 402 †
Bulgaria, Photographs of, by N. E. Buxton, 539 †
Burgklehner, Mathias, Tirolische Landtafeln, 785 †
Burma—
Burma under British Rule—and Before, by John Nisbet, 524 †
Railway communication between Western China and, 273, 276
Vertebrate Animals in India, Ceylon, and, Distribution of, by W. T. Blanford, 524 †; note on, 633
Burrard, Major S. G., The Attraction of the Himalaya Mountains upon the Plumb-line in India, review of, by E. A. Reeves, 615
Burton, Captain R. G., The Conquest of Java, 654 †
Buschan, Dr., Verbreitung, Eintheilung und Ursprung der slavischen Völkerstämme, 523 †
Busoga, Uganda Protectorate, 20
Bussorah, Trade of (Foreign Office Rep.), 231 †
Busumchwi, Lake, Mr. M. Fergusson's account of, 370
Buvuma island, Victoria Nyanza, 18
Buxton, N. E., Photographs of Bulgaria, 539 †
Buxton, Sir T. Fowell, remarks on the "Artesian Water-supply of Australia," 571

C.

Cacao—
Theobroma Cacao, 526 †
Cahers of County Clare, their Names, etc., by T. J. Westropp, 523 †
California—
Salt Deposit, A remarkable, by C. F. Holder, 529 †
Calisti, Lieut., Région Kati-Bamako, 246 †
Callaway, Dr. C., The Zigzag Course of the Cheddar Gorge, 767 †; note on, 501
Cambodia—
Cambodge, Le, par E. Aymonier, 395 †
Camel—
Fossiles Kamel aus Südrussland, von Dr. A. Nehring, 238 †
Campbell, D. G., Annual Report on the State of Negri Sembilan, 105 †
Campbell, Rev. J., Mexican Colonies from the Canary Islands traced by Language, 529 †
Campbell, W. D., and the late S. J. Becher, Topographical Map of Kalgoorlie, 665 †
Canada—
Birds, Catalogue of, by J. Macoun, 529 †
Coal Measures of, 219
Canada—*continued*.
Early Explorations and Colonisation of Western Canada, by Sir J. Hector, 658 †
Early Trading Companies of New France, by H. P. Biggar, review of, 745
Eboulement à Saint Luc-de-Vincennes, par J. Laflamme, 528 †
Exploration in the Country between Lake St. John and James Bay, Report on the Progress of, by H. O'Sullivan, 234 †; note on, 91
Geographical Survey of, by J. White, 658 †
Geological Survey. Annual Report, 234 †
Geology of, Synopsis of, by H. M. Ami, 529 †
Great Bear Lake Region, Photographs of, by J. Macintosh Bell, 119 †
Modifications remarquables causées à l'Embouchure de la Rivière Ste. Anne par l'Eboulement de St. Alban, par J. Laflamme, 528 †
Rockies, Canadian, In the Heart of the, by L. J. Steele, 529 †
Canary Islands—
Kunde des Altertums von den Canarischen Inseln, von C. Müller, 106 †
Madeira and the, by A. Samler Brown, 107 †
Cantineau, E., Origine des relations commerciales entre la Flandre et le Portugal, 522 †
Canton—
Letters from Portuguese Captives in, by D. Ferguson, 768 †
Trade routes from, 712, 713
Cape Colony—
African Wastes Reclaimed, by R. Young, 771 †
Alpine Types in the Vegetation of the Higher Peaks of the South-Western Region of, by R. Marloth, 107 †; note on, 637
Geological Commission, Annual Report of the, 655 †
Place-names at the Cape in the Eighteenth Century, M. Déhérain on, 217
Report of His Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty, 398 †; note on, 90
Statistical Register of the Colony of the Cape of Good Hope, 526 †
Cape Verd Islands—
Maps: Archipelago de Cabo Verde (Commissão de Cartographia), 787 †
Carden, —, Trade of the Island of Cuba (Foreign Office Rep.), 110 †
Carles, W. R., letter from, on the Kinsha River of West China, 518; remarks on "From Shanghai to Bhamo," 275
Carlheim-Gyllensköld, V., Travaux de l'éxpedition suédoise au Spitzberg pour la mésure d'un arc du méridien, 532 †

Carmarthenshire Note on a Submerged and Glaciated Rock-Valley in, by T. Codrington, 767 †
Caroline Islands—
Karolinen, Die, von Dr. M. Friederichsen, 777 †
Karolinen und Marianen, Einige Ergebnisse einer Reise nach den, von Dr. G. Volkens, 777 †
Carpathians—
Eiszeit in den Südkarpaten, von S. Puchleitner, 228 †
Carpentaria, The Diocese of, and the Bishop of Carpentaria's journey, 778 †
Carpenter, G. H., Collembola from Franz-Josef Land, 531 †
Carrasco, G., Cálculo de la población probable de la República [Argentina] al entrar al siglo XX., 402 †
Cartography—
Cartographie en 1900, par E. Olivier, 405 †
Erdkarte in Maassstab 1 : 1,000,000, Ueber die Herstellung einer, von Dr. A. Penck, 405 †
Hochgebirgs-Karten, Ueber, von Prof. Dr. E. Oberhummer, 405 †
Nouvelle Cartographie Horaire, par Prof. H. Frassi, 405 †
Reliefs, Un nouveau Procédé de Construction des, par A. de Claparède, 405 †
Casati, Major, obituary of, 646
Cascade Mountains of Northern Washington, Climate, etc., of, by I. C. Russell, 529 †
Cash, C. G., The First English Map of India, 653 †; The First Topographical Survey of Scotland, 104 †
Caspian Sea—
Chemistry of the, by A. Lebedintseff, 652 †
Cassel, M. Van, La Haute Côte d'Ivoire occidentale, 233 †
Caucasia—
Mammals of the Steppes of the North-Eastern Caucasus, by K. A. Satunin, 769 †
Promenade au Caucase et dans le Turkestan, par M. H. Primbault, 397 †
Reiseskizzen aus Transkaukasien, von W. v. Landesen, 231 †
Stellung von Kolchis in den feuchten subtropischen Gebieten der Erde, von Prof. A. Krassnow, 397 †
Cayeux : *see* Ardaillon
Cazemajou, Le Capitaine, par J. Léotard, 241 †
Ceara—
Algumas origens do Ceará, por A. Bezerra, 236 †
Lingua Indigena—O nome Ceará, por Mendes e Sampaio, 236 †
Celebes—
Geographisch-Geologischen Beschreibung der Insel Celebes, Entwurf
Celebes—*continued.*
einer, von Drs. Paul und Fritz Sarasin, 525 †
Mededeelingen omtrent de Toradja's van Midden Celebes, door Dr. N. Adriani, 397 †
Ceylon—
Handbook and Directory and Compendium of Useful Information, edited by J. Ferguson, 105 †
Ruines de Pollanarouwa, Une visite aux, par A. M. Évrard, 396 †
South-Central, Notes on the Geology of, by J. Parkinson, 105 †
Vertebrate Animals of India, Ceylon, and Burma, Distribution of, by W. T. Blanford, 524 †; note on, 633
Chaco, Bolivia, 71
Chad—
Autour du Tchad, par Capitaine Joalland, 528 †
Chagres river, Panama, 329
Chaix, P., Notice sur les Vallées Vaudoises du Piémont, 522 †; Notice sur les Travaux de Paul Chaix, par E. Chaix, 409 †
Chambezi and Chozi rivers, B. C. Africa, 605
Chang-sha, Hu-nan province, 722
Channel Islands, Ordnance Survey map of, 784 †
Chantre, E., Les Bédouins d'Egypte, 527 †
Charisius, Hauptmanns, Reisebericht des, 528 †
Charpentier, M., Ce que doit être le canal des Deux-Mers, 649 †
Charts, New—
Admiralty, 117, 415, 666
Cancelled, 118, 415, 667
Corrected, 118, 416, 667
Danish, 538
North Atlantic and Mediterranean, 119, 248, 416, 538, 667, 787
Russian, 416, 668
United States Hydrographic, 119, 248, 416, 538, 668, 787
Chatseringhi-huduk, Tibet, 581
Cheddar Gorge, The Zigzag Course of the, by Dr. C. Callaway, 767; note on, 501
Cheling, route from Canton, 713; pass, 733
Chemical and Physical Notes, by J. Y. Buchanan, 111 †
Cheng-tu, China, 250
Cheviots—
Glacier-dammed Lakes in the, Evidences of, by P. F. Kendall and H. B. Muff, 229 †
Chewings, C., Notes on Glacial Beds of Cambrian Age in Far North of South Australia, 237 †
Chewings, Miss Hannah, Amongst Tropical Islands, 531 †
Chian-kiang, China, 251
Chicago—
Physiographic Ecology of Chicago and Vicinity, by H. C. Cowles, 235 †

Chiengmai, Trade of (Foreign Office Rep.), 106 †
Chile (*see also* Patagonia)—
Anuario hidrografico de la Marine de, 775 †
Boundary Dispute between Chile and Argentina, by Hope Gibson, 775 †
Diccionario Biográfico de Estranjeros en Chile, por P. P. Figueroa, 240 †
Fronteras del Norte, El Problema de nuestras, por Pedro P. Figueroa, 109 †
Messungsmethoden der chilenischen Grenzkommission, von Prof. Dr. E. Hammer, 530 †
Question of the Pacific, by Dr. V. Maurtua and F. A. Pezet, 776 †
Regen in Südchile, von Dr. K. Martin, 109 †
Southern Archipelagoes of, Depressions and Elevations of the, by F. V. Gormaz, 775
Chi-li, Wege-Aufnahmen im nördlichen Teil der Provinz, von Dr. K. Vogelsang, 245 †
Chimanimani pass, Manika, 372
China—
Britain's Trade with, by H. Kopsch, 105 †
China and the Far Eastern Question, by Rev Dr. Eitel, 768 †
China in Convulsion, by A. H. Smith, 652 †
China und die Chinesen, von B. Navarra, 524 †
Commerce entre la France et la Chine, Développement possible du, par E. Frandon, 230 †
Empire du Milieu, par E. et O. Reclus, 768 †
Histoire des Relations de la Chine avec les puissances occidentales, par H. Cordier, 652 †
Imperial Railway of North China, Correspondence respecting the, 229 †
John Chinaman and a few others, by E. H. Parker, 105 †
Kinsha river of, letter from W. R. Carles on, 518
Land of the Blue Gown, by Mrs. Archibald Little, 768 †
Landschaft Kwantung im russischen Besitze, von Hauptmann Immanuel, 768 †
Navigation à vapeur dans le Se-tch'ouen, par C. Madrolle, 768 †
Photographs of, from Hankau to Canton, by W. B. Parsons, 668 †
Premiers voyages français à la Chine, par C. Madrolle, 652 †
Problema de la China, por F. de Antón del Olmet, 524 †
Reise nach Schehol in Nord-China auf dem Lan-hô, Kurzer Bericht über eine, von K. Nishiwada, 652 †
Some little-known Features of, by Rev. Dr. Eitel, 369†
China—*continued*.
Trade and Trade Reports, Returns of, 396 †
Western, and Burma, question of railway communication between, 273, 276
Yang-tse Kiang to the China Sea, From the, by W. B. Parsons, 711
China Sea, From the Yang-tse Kiang to the, by W. B. Parsons, 711 *
China Sea Directory, Supplement 1901, relating to, 230 †
Chinese Turkestan, Preliminary Report on a Journey of Archæological and Topographical Exploration in, by M. A. Stein, 769 †
Chin-Wan-Tao, Note sur la détermination . . . de la longitude de, par M. Pirot, 652 †
Chirikof, Voyage of, on the North-West Coast of America, Prof. G. Davidson on, 756, 774 †
Chirripo Grande mountains, Costa Rica, 318
Chisholm, G. G., award to, 630, 648; letter from, on Waldseemüller's "Solidum," 389; review of Adam's Text-book of Commercial Geography, 747
Church, Colonel G. E., Bolivia by the Rio de la Plata Route, 64 *; Intercéanic Communication on the Western Continent, 313 *; Northern Bolivia and President Pando's New Map, 109 †; review of Keane's Central America and West Indies, 622
Cilvanet, C., Le Recensement de 1901 en France, 649 †; Les Recensements de Population, 392 †
Claparède, Dr. A. de, De quelques particularités de la première et de la seconde Cataracte du Nil, 399 †; Note sur le grand Barrage du Nil au dessous d'Assouan, 399 †; Un nouveau Procédé de Construction des Reliefs, 405 †
Clark, Sir Andrew, obituary of, 763
Class Excursions in Wales and England, by J. B. Reynolds, 241 †
Clay, red, of deep-sea deposits, 694, 696, 705, 708
Clayton, H. H., The Influence of Rainfall on Commerce and Politics, 533 †; note on, 512
Cleeve, Major F. J. S., A System of Comparing Geographical Distances, 405 †
Cleve, A., Beiträge zur Flora der Bären-Insel, 531 †; Zum Pflanzenleben in nordschwedischen Hochgebirgen, 523 †
Cleve, P. T., Notes on some Atlantic Plankton-organisms, 781 †
Cleve, P. T., G. Ekman, et O. Pettersson, Les variations Annuelles de l'eau de surface de l'Océan Atlantique, 533 †
Clifford, H., Annual Report on the State of Pahang, 105 †
Climatic Contrasts, Dr. L. Coellen on, 222
Clitheroe and Pendle Hill, Notes on the Geology of, by R. H. Tiddeman, 104 †

Close, Major C. F., A Sketch of the Subject of Map Projections, 238 †; review of, 78
Close, Rev. M. H., Hipparchus and the Precession of the Equinoxes, 532 †; Remarks on a Cosmographical Tractate in the Irish Language, 406 †
Coasts—
Sea Coast, The, by W. H. Wheeler, 660 †
Codrington, Robert, A Voyage on Lake Tanganyika, 598 *
Coellen, Dr. Ludwig, on Climatic Contrasts, 222
Coghlan, T. A., Picturesque New South Wales, 777 †
Cole, G. W., Bermuda and the *Challenger* Expedition, 658 †
Coleman, Prof. A. P., The Relations of Changes of Level to Interglacial Periods, 661 †
Collett, O., Pearl Oysters and Pearl Fisheries, 408 †
Collot, M., Goniatites carbonifères dans le Sahara, 108 †
Colonial Administration, by O. P. Austin, 782 †
Colonial Administration in different parts of the World, by P. Bigelow, 241 †
Colonial Bibliography, New French, 762
Colonies—
Problème Colonial au Début du XX^e^ siècle, par M. Zimmermann, 783 †
Colonization—
Methods of Government and Development adopted by the principal Colonizing Nations, etc., 533 †
Colorado—
Grand Canyon du, Les Enseignements du, par W. M. Davis, 401 †
Colquhoun, A. R., remarks on "From Shanghai to Bhamo," 274; The Mastery of the Pacific, 777 †
Columbia—
Frontera entre Costa Rica y Colombia, Los "Geographische Mitteilungen" y la, 109 †; note on, 93
Commerce—
Influence of Rainfall on Politics and, by H. H. Clayton, 533 †; note on, 512
Obstructions to Commerce, and how to remove them, by L. M. Haupt, 239 †
Compass—
Admiralty Manual for the Deviations of the, edited by F. J. Evans and A. Smith, 110 †
Conder, Colonel C. R., Zuallardo's Travels, 654 †; note on, 783
Congo—
Alger au Congo par le Tchad, De l', par F. Fourcau, review of, 196
Ancient Kingdom of Kongo: its Present Position and Possibilities, by Rev. Thomas Lewis, 541 *
Compagnie du Congo pour le Commerce et l'Industrie, 527 †
Compagnie du Kasai, 527 †
Congo—*continued.*
Congo State and the Bahr-el-Ghazal, by E. P. Morel, 232 †
Congo-Zambezi Water-parting, by Captain C. Lemaire, 173 *
Exploration de la section Septentrionale de la chaine des Mitumba le long des lacs Tanganika et Kivu, par A. J. Wauters, 398 †
French: Le Congo français, par M. Aspe-Fleurimont, 399 †; La moyenne Nyanga, par M. Rouhaud, 528 †; Dans le Haut-Oubangui, 528 †; M. D. de Pauwel's explorations between the Sanga and Ubangi, 639
Frontière entre le Cameroun et le Congo, Une violation de la, 400 †
Ka-Tanga, Mission Scientifique du, par Captain C. Lemaire, 526 †, 527 †
Maps: Le Lomami Inférieur, par A. J. Wauters, 246 †
Notices sur le Bas-Congo, par H. Droogmans, 771 †
Portuguese Congo, Itineraries in, by Rev. T. Lewis, 526 †
Railways in the, 374
Telegraphs on the, Mr. Mohun's expedition, 89
Connecticut, River System of, by W. H. Hobbs, 235 †; note on, 91
Constance, Lake of—
Verbreitung der Thierwelt in Bodensee, von T. Fuchs, 522 †
Consular Reports—
Index to Reports of His Majesty's Diplomatic and Consular Representatives, etc., 662 †
Cook, Captain, On the Tracks of, by Prof. E. E. Morris, 777 †
Cook, F. A., The People of the Farthest North, 660 †
Cook, W. H., Photographs of Alaska and British Columbia, 538 †
Coolidge, W. A. B., La Catena della Levanna, 391 †; La Légende du Mont Iseran, 381 †
Coonley, Davenport, and Mancel, Messrs., Photographs of the Bahamas, 539 †
Copper or Atna river, Alaska, 610
Cora, Prof. G., Africa a Base Fisica, 245 †; America Sud a Base Fisica, 247 †; La Spedizione Artica di Fridtjof Nansen, 405 †
Coral mud of deep-sea deposits, 693, 698, 711
Cordeiro, Luciano, por F. J. Ferreira do Amaral and Z. C. Pedroso, 782 †
Cordier, H., Histoire des Relations de la Chine avec les puissances occidentales, 652 †
Cornet, M. Jules, on the Congo-Zambezi water-parting, 174
Cornish, Vaughan, on Waves, note on, 380; Cinematographing the Severn Bore, 52 *
Cosmographical Tractate in the Irish

Language, Remarks on a, by Rev. M. H. Close, 406 †
Costa, Gomes da, Notas para o Diccionario Chorographico da Provincia de Moçambique por, 108 †
Costa Rica—
Frontera entre Costa Rica y Colombia, Los "Geographische Mitteilungen" y la, 93, 109 †
Interoceanic communication in, 318, 324
Cotes, Annie Russell, Westward from the Golden Gate, 105 †
Coupe de Jaujac, The, by T. Anderson, 392 †
Coville, F. V., The Willows of Alaska, 108 †
Cowles, H. C., The Physiographic Ecology of Chicago and Vicinity, 235 †
Cox, W. Gibbons, The Artesian Water-supply of Australia from a Geographical Standpoint, 560 *; The Water Supply of Australia, 530 †
Crabtree, Rev. W. A., Concerning a Former Roman Catholic Mission on the Upper Nile, 232 †
Crammer, Prof. H., on the Bedding, Foliation, and Movement of Glacier Ice, 512
Credner, Prof. Dr., Ueber die geologischen Wirkungen des Windes, 532 †
Crete—
Mission de MM. Ardaillon et Cayeux dans l'île de Crête, par V. L., 523 †; note on, 212
Cruickshank, J. W. and A. M., The Umbrian Towns, 394 †
Cuba—
Maps: Indexed Pocket Map of (Rand, McNally & Co.), 246 †
Trade of (Foreign Office Rep.), 110 †
Cucalón, General I., Factores que más han contribuido á los descubrimientos geográficos, 661 †
Current Papers, by H. C. Russell, 781 †
Currents—
Drift of Floating Bottles in the Pacific Ocean, by James Page, 111 †
Cust, R. N., Some Remarks on the Royal Asiatic Society of Great Britain and Ireland, 663 †
Cvijić, Prof., explorations of the Scutari Lake, 211; on the Structure of the Balkan Peninsula, by Dr. Carl Peucker, 735
Cyprus—
A Winter Pilgrimage: Being an Account of Travels through Palestine, Italy, and, by H. Rider Haggard, 242 †
Czink, Prof. L., Lussino, Isola dell' Istria, 765 †

D.

Dahomey—
Chemin de fer du Dahomey, par A. Montell, 527 †
Dainelli, G., Stato attuale dei ghiacciai del Monte Rosa, 522 †
Daiber, Dr. A., Eine Australien und Süd seefahrt, 776 †
Dal or Nesla, 74
D'Albertis, L. M., e della sua opera scientifica, del dott. A. Mochi, 409 †; (Biography of), 662 †
Dalma island, Persian gulf, 55
Daly, R. A., The Geology of the North-East Coast of Labrador, 774 †
Danckelman, Dr. v., Die Höhenmessungen von Dr. Esch in Kamerun, 656 †
Danish Admiralty Charts, 538 †
Danish Expedition to Greenland, 641
Dantec, Dr. le, Le paludisme, sa prophylaxie, 112 †
Danube—
Sprengung des Eisernen Thors und die freie Donauschiffahrt, von M. v. Eyth, 103 †
Darjiling, N. India, 462, 473
Darlac, une province laotienne, par C. M., 769 †
Darwáza-i-Nádir, Persia, 159
Datta: *see* Oldham
Davenport: *see* Coonley
Davidson, Prof. G., on the origin of the name of Cape Nome, 92; The Copper River of Alaska, 773 †; on the Voyages of Bering and Chirikof on the North-West Coast of America, 756, 774 †
Davies, A. M., The Geography of Greater London, 767 †
Davis, A. M., remarks on the "Teaching of Geography," 82
Davis, A. P., Hydrography of Nicaragua, 403 †
Davis, Prof. W. M., Les Enseignements du Grand Canyon du Colorado, 401 †; The Geographical Cycle, 407 †
Davis, W., Maps of the Mississippi River, 775 †
Dawkins, Prof. W. Boyd, The Influence of the Mediterranean Peoples in Prehistoric Britain, 395 †
Dead Sea—
Mer Morte, La, par L. Gautier, 654 †
Debai, Northern Oman, 56
Debasien mountain, Uganda Protectorate, 17
Deburaux, M., Sur un projet de traversée du Sahara, par ballon non monté, 772 †
Debureau, M., La Ville et le Comté de Marans, 227 †
Déchy, Moriz v. (Biography), 534 †
Deeken, R., Manuia Samoa! 659 †
Deep-Sea Deposits and their Distribution in the Pacific Ocean, by Sir John Murray, 691 *
Déhérain, H., on Place-names at the Cape in the Eighteenth Century, 217
De la Blache, P. De l'Habitation sur les plateaux limoneux du Nord de la France, 392 †; Vidal, La Rivière Vincent Pinzon, 657 †
De la Vaulx, Cte. Henry, L'aéronautique

maritime: la traversée du "Méditerranean," 534 †
Delaware Ship Canal, 641
Delme-Radcliffe, Major, remarks on "A Journey from Omdurman to Mombasa," 689
Deniker, J., La première photographie de Lhassa, 397 †
d'Enjoy, P., Le pays d'Annam, 230 †
Denmark—
Danske Turistforenings Aarsskrift, 1902..649 †
Denmark past and present, by Margaret Thomas, 765 †
Océanographie des détroits danois, par M. Knudsen, 649 †
Dentzer, Dr. B., Topographie der Feldzüge Robert Guiscards gegen das byzantinische Reich, 103 †
Derby, Major G. M., on the Changes in the Mississippi Flood-level, 508
Desbats, G., La mission de la Société d'océanographie en Espagne et en Portugal, 767 †
Deschamps, L., La France et l'Angleterre devant l'Islam, 409 †
De Windt, J., Sur les distances moyennes à la côte dans les océans, 239 †
De Windt, Harry, Finland as it is, 228 †
De Winton, Sir Francis, obituary of, 223
Diatom ooze of deep-sea deposits, 694, 698
Dickson, H. N., The Circulation of the Surface Waters of the North Atlantic Ocean, review by Dr. H. R. Mill, 354
Dickson, W. K., The life of Major-General Sir Robert M. Smith, 112 †
Didessa river, Abyssinia, 88
Diest, W. v., Karte des nordwestlichen Kleinasien in vier Blättern, 114 †
Dijon, Le relief des environs de, etc., par P. Girardin, 766 †
Dilolo lake, Congo basin, 176
Dingelstedt, V., Anthropological Investigations in the Alps and the Caucasus, 533 †
Disco Island—
Beretning om en Undersøgelsesrejse til Øen Disco Sommeren 1898, af K. J. V. Steenstrup, 405 †; note on, 379
Discovery, The, Arrival at Lyttelton, N.Z., 97, 102; List of Officers and Crew, 448; The Voyage Southward of the, I. London to Madeira, by Dr. H. R. Mill, 417 *; II. From Madeira to the Cape, by George Murray, 423 *; III. The *Discovery* and the Relief Ship, by Sir Clements Markham, 435 *
Dittmer, R., Das Nord-Polarmeer, 404 †
Dix, Arthur, Deutschland auf den Hochstrassen des Weltwirtschaftsverkehrs, 393 †
Dixon, R., Index to Names and Places, Mines, etc., occurring in the Geological Survey Reports, Queensland, 531 †
Djibuti à Harar, Le chemin de fer de, 656 †
D'Ollone, Capt., Les populations Anthropophages du Cavally, 399 †
Dolomites—
Engadin-Ortler-Dolomiten, von Theodor und Maud Wundt, 103 †
Domira Bay, Lake Nyasa, Journey from, to Fife, on the Tanganyika Plateau, by Ch. McKinnon, 603 *
Donner, O., Voyage en Turkestan et en Dzoungarie en 1898..652 †
Donnet, F., Deux lettres de Bory de Saint-Vincent, 662 †
Dorsey, G. A., Archæological Investigations on the Island of La Plata, Ecuador, 402 †
Doutté, Ed., Une Mission d'études au Maroc, 657 †; note on, 375
Dove, Prof. Dr. K., Meteorologische Beobachtungen aus den Deutschen Schutzgebieten, 112 †; Swakopmund einst und jetzt, 233 †
Drapeyron, Prof. L., Enquête sur la première grande Carte topographique, celle de France, 392 †
Drizhenko, Colonel, expedition to Lake Baikal, 754
Droogmans, H., Notices sur le Bas-Congo, 771 †
Drude, Dr. O., Ueber die Ausbildung der pflanzengeographischen Kartographie, 407 †
Dryer, C. R., Lessons in Physical Geography, 239 †; review of, 629
Drygalski, Dr. E. v., Die Deutsche Südpolar-Expedition, 404 †, 531 †, 660 †, 778 †
Dübi, Dr. H., Bergreisen und Bergsteigen in der Schweiz, 104 †
Dubois, M., et A. Terrier, Un siècle d'expansion coloniale, 242 †; Les Colonies Françaises, 783 †
Du Bourg de Bogas, M., expedition in Abyssinia, 755
Duffart, C., Sur l'âge des dunes et des étangs de Gascogne, 227 †
Dufferin and Ava, The Marquis of, obituary of, 384
Dundry Hill, Excursion to, by S. S. Buckman, 651 †
Dunstan, Prof. W. R., on the Coal Resources of India, 752
Duparc and Pearce, MM., Sur les roches éruptives du Tilai-Kamen, 228 †
Durukshi, Persia, 151
Dusén, P., Beiträge zur Flora der Insel Jan Mayen, 531 †
Dust-rain—
Staubfall von Marz, 1901, in Nordafrika, etc., Der grosse, von G. Hellmann, und W. Meinardus, 780 †
Dutch East Indies—
Dagh-Register gehouden int Casteel Batavia, van J. A. van der Chijs, 653 †
Dyé, Lieut. A. H., Positions géographiques déterminées astronomiquement en Afrique Centrale au cours de la Mission Marchand, 655 †; note on, 505

E.

Earth—
Antlitz der Erde, Das, von Ed. Suess, 111 †
Entwickelung unserer Erde, Die erste, nach P. Engelbrethsen, 238 †
Erde und das Leben, von Prof. Dr. F. Ratzel, review of, 500
Gestaltungsprincips der Erde, von P. Reibisch, 780 †
Pole of the, oscillation of the, 642
Earthquakes—
Beziehungen zwischen Erdbeben und Detonationen, von J. Knett, 661 †
East, The Nearer, by D. G. Hogarth, 783 †
Ebeling, Dr. Max, Die Anfertigung von Reliefs in der Schule und für die Schulen, 241 †
Eckel, E. C., The Formation as the Basis for Geologic Mapping, 660 †
Ecuador—
Interoceanic communication in, 315
Education: *see* Geography.
Edwards, O. M., Wales (Story of the Nations Series), 651 †
Egypt—
Archæology, Egyptian, A Concise Dictionary of, by M. Brodrick and A. A. Morton, 527 †
Bédouins d'Égypte, par E. Chantre, 527 †
Guide to Palestine and (Macmillan & Co.), 410 †
Handbook for Travellers, by Karl Baedeker, 399 †
Irrigation and Surveys in 1900, note on Sir W. Garstin's report on, 507
Journey from Farafra to Siwa, by W. Jennings-Bramly, 73 *
Light Railways in, by J. A. W. Peacock, 399 †
Macmillan's Guide to, review of, 366
Publications, Maps, and Plans published by the Public Works Ministry, 232 †, 771 †
Public Works Department, Report upon the Administration of the, by Sir W. E. Garstin, 232 †
Eifel—
Région montagneuse de la rive gauche du Rhin, par G. Six, 393 †
Eitel, Rev. Dr., Some little-known features of China, 396 †; China and the Far Eastern Question, 768 †
Ekstam, Dr., expedition to Novaya Zemlya, 221
Elbe—
Bewegung des Elbwasserstandes bei Magdeburg, von Prof. J. Maenss, 522 †
Statistik der sächsischen Elbverkehrs, von Dr. K. Ganzenmüller, 521 †
Elgeyo escarpment, Uganda Protectorate, 9
Elgon, Mount, Uganda Protectorate, 13; Caves and waterfall of, 14: On the Slopes of, by Rev. and Mrs. Crabtree and Rev. T. R. Buckley, 655 †
Elliot, D. G., A List of the Land and Sea Mammals of North America north of Mexico, 529 †
Ells, R. W., The Physical Features and Geology of the Palæozoic Basin between the Lower Ottawa and St. Lawrence Rivers, 528 †
El M'Til, ruins at, Morocco, 191
Empire, The Harmony of the: being a Series of Sketches in Pictorial Geography of the British Possessions, etc., 534 †
Engelbrethsen, P., Die erste Entwickelung unserer Erde, 238 †
Engell, Dr. M. C., Den terrestriske Nordpols Variation, 406 †; on the Oscillation of the Terrestrial Pole, 642; Beiträge zur Kenntnis der geographischen verhältnisse von "Les Landes," 766 †; note on, 750
Engineering Congress, International, 783 †
England—
Dust Shower in the South-West of, 767 †
Scenery of, and the Causes to which it is due, by Lord Avebury, 767 †
Wachstum Englands, Das, von Dr. J. Heiderich, 662 †
England and Wales—
Maps: Geological Survey, 411 †; Ordnance Surveys, 113 †, 243 †, 410 †, 535 †, 663 †, 784; Reduced Ordnance Survey, by J. Bartholomew, 535 †, 664 †
Erichsen, Mylius, expedition to Greenland, 641
Erie, Lake, Proposed raising of the level of, 756
Eritrea—
Arsilée e Golima, il paese degli 'Afár tra Assab e l'Aussa, di G. Cora, 233 †
Carta dimostrativa della Colonia Eritrea e regioni adiacenti e le critiche del Prof. G. Cora, 528 †
Censimento delle popolazione indigene della Colonia Eritrea, del Carlo Rossini, 656 †
Sulle odierne Condizioni dell' Eritrea, di A. Parazzoli, 233 †
Erlanger, Baron, Expedition in North-East Africa, 87
Errera, Prof. C., L'epoca delle grandi scoperte geografiche, 661 †
Erzgebirge—
Tremblements de terre de plissement dans l'Erzgebirge, par F. de Montessus de Ballore, 649 †
Estreicher, T., Globus Biblioteki Jagiellonskiej z pocaztku w. XVI., 409 †
Ethnology—
Rassen und Völker, von Dr. L. Wilser, 409 †
Etna, Height of, 211
Etna or Copper river, Alaska, 610
Euphrates, gorges of the, Photographs of,

by Messrs. Huntingdon, Knapp & Ward, 788 †
Europe—
Astronomisch-Geodätischen Arbeiten des K. und K. Militär-Geographischen Institutes in Wien, 392 †
Condominium dans l'Europe Centrale: Moresnet, 392 †
Gebirgsbau der Ägäis und seine allgemeineren Beziehungen, von Prof. Dr. A. Philippson, 392 †
Geografia delle *Gallie* sotto l'Impero Romano, del Prof. F. P. Garofalo, 392 †
Geografia Greca, Studi di, del Prof. F. P. Garofalo, 392 †
Halophilen Phanerogamen in Mitteleuropa nördlich der Alpen, Die Verbreitung der, von Dr. A. Schulz, 391 †
Historical Atlas of Modern Europe, from the Decline of the Roman Empire, edited by R. L. Poole, 411 †
Hydrographisch-biologische Erforschung der Meere, Binnen-meere, und tieferen Seen Europas, Ueber systematische, von Prof. O. Pettersson, 392 †
Landhöjningen vid Rusterna af Östersjön och Kattegat, af A. Bonsdorff, 650 †
Maps: General Map, by H. Barrière, 411 †; Carte Géologique international de l'Europe, 411 †
Recensements de Population, par C. Cilvanet, 392 †
Southern, Crust-Basins of, by Mrs. Ogilvie Gordon, 395 †
Topographie der Feldzüge Robert Guiscards gegen das byzantinische Reich, von Dr. B. Dentzer, 103 †
Veröffentlichung des Königl. Preussischen Geodätischen Institutes, 766 †
Evans, F. J., and A. Smith, Admiralty Manual for the Deviations of the Compass, 110 †
Evaporation Underground, by E. S. Balch, 780 †
Everest, Mount, or Jomokangkar, by D. W. Freshfield, 653 †
Évrard, A. M., Une visite aux ruines de Pollanarouwa, 396 †
Eyre, Edward John, obituary of, 99
Eyre, Lake, South Australia, Prof. Gregory's expedition to, 377, 509, 607
Eyth, M. v., Die Sprengung des Eisernen Thors, 103 †
Eyuk and Boghaz, A Visit to the Hittite Cities of, by Rev. G. E. White, 770 †

F.

Fabre, L. A., L'érosion pyrénéenne et les alluvions de la Garonne, 766 †
Fahraj, Persia, 160
Farafra to Siwa, A Journey from, 1898, by W. Jennings-Bramly, 73 *
Farsan Islands—
Kohlenstationen und die Farisan-inseln, von Z. D. Plüddemann, 768 †
Favre, Colonel C., Carte du Théatre de la Guerre Sud-Africaine, 536 †
Fawcett, Captain P. H., Journey to Morocco City, 189 *; Photographs of Morocco, 540 †
Fawcett, F., Madras Government Museum. Nâyars of Malabar, 396 †
Faxebugt bay, Iceland, 613
Fayûm—
Fayûm Depression, The, by H. J. L. Beadnell, 399 †
Felber, T., Die Allmenden des alten Landes Schwyz, 523 †
Ferguson, D., Letters from Portuguese Captives in Canton, etc., 768 †
Ferguson, J., The Ceylon Handbook and Directory, etc., 105 †
Fergusson, M., account of Lake Busumchwi, Ashanti, 370 †; Geological Notes from Tanganyika Northwards, 232 †; Photographs of Ashanti, 538 †
Fermier, P., Nouvelles observations géologiques sur la chaîne de Belledonne, 649 †
Fetishism, A Government, by R. H. Nassau, 400 †
Figueroa, J., observations on the Tides and Sandbanks in the La Plata Estuary, 93
Figueroa, P. P., Diccionario Biográfico de Estranjeros en Chile, 240 †; El Problema de nuestras Fronteras del Norte, 109 †
Fiji—
Meteorological Observations taken at Siwa, by J. D. W. Vaughan, 530 †
Finland—
Finland as it is, by Harry de Windt, 228 †
Hufvudtyper inom de sydfinska landskapsformerna och berggrundens betydelse för uppkomsten af dem, af B. Frosterus, 651 †
Katalog öfver trigonometriska och astronomiska punkter i södra Finland, etc., 766 †
Population en Finlande, La densité de la, par E. R. Neovius, 766 †
Russie et la Finlande, Le conflit entre la, par J. Leclercq, 229 †
Skogarnas inflytande på Finlands Klimat, af T. Homén, 651 †
Strandbildningar och marina gränsen i södra österbotten och angränsende trakter, af R. Hammarström, 651 †
Finn, A., Apuntes de un viaje en Persia, 231 †
Finsterwalder, Dr., et E. Muret, Les variations périodiques des Glaciers, 407 †
Fiords, by G. D. Hubbard, 532 †
Firth, J. B., The Albany Settlement, 106 †
Fischer, Dr. H., Der Geographieunterricht

an den preussischen höheren Schulen und die Juni-konferenz, 227 †
Fischer, Jos., Die Entdeckungen der Normannen in Amerika, 658 †; review of, 746
Fish River Bush, South Africa, by W. T. Black, 655 †
Fitzner, Dr. R., Deutsches Kolonial-Handbuch, 534 †
Flahault, M., researches on the rivers and forests in Russia, 751
Flamand, G. B. M., Sur la position géographique d'In-Salah, 528 †; note on, 375
Flanders—
Origine des relations commerciales entre la Flandre et le Portugal, por E. Cantineau, 522 †
Flinders, Captain, Memorial to, 759
Floericke, Dr. C., Marokko, 657 †
Florida—
Maps: Indexed Pocket Map of (Rand, McNally & Co.), 247 †
Föhn—
Entstehung des Föhns, Die, von Prof. Dr. Höfler, 111 †
Forbes, D., Reminiscences of the Early Days of the present Colony of Queensland, 237 †
Ford, J. T., The Present Condition and Prospects of the Panama Canal Works, 110 †
Fordham, H. G., Hertfordshire Maps, 523 †
Foreign Mission Atlas, by Dr. G. Smith, 415 †
Forel, Dr. F. A., Les seiches de Genève, 104 †; Les Seiches des Lacs, 407 †; Le Léman, 767 †
Formæ Orbis Antiqui, von R. Kiepert, 537 †
Formosa, North, Trade of (Foreign Office Rep.), 525 †
Fort Jameson, Rhodesia, 603
Forth Valley, Sir John Murray's Scheme for the Investigation of the Natural History of the, by Marion Newbigin, 651 †
Forty-mile, Yukon Territory, Mr. Gordon's account of, 640
Foster, A., Régimen del Rio de la Plata y su corrección, 658 †; on the regulation of the Paaraná river, 759
Foster, J. W., The New Mexico, 774 †
Foureau, F., De l'Alger au Congo par le Tchad, 196; Mission Saharienne Foureau-Lamy. D'Alger au Congo par le Tchad, 400 †
Fournier, E., Les phénomènes de capture des cours d'eau superficiels par les cours d'eau souterrains, dans les régions calcaires, 533 †; note on, 512
Fox, Dr. R., Das Gesenke, 103 †
France—
Canal des Deux-Mers, Ce que doit être le, par M. Charpentier, 649 †
Chaîne de Belledonne, Nouvelles observations géologiques sur la, par P. Fermier, 649 †
Dépôts littoraux et mouvements du sol pendant les temps secondaires, par A. Thevenin, 227 †
Dunes et des étangs de Gascogne, Sur l'âge des, par C. Duffart, 227 †
Enquête sur la première grande Carte topographique, celle de France, par Prof. L. Drapeyron, 392 †
Erosion pyrénéenne et les alluvions de la Garonne, par L. A. Fabre, 766 †
Geographischen Charakteristik der Bretagne, Beiträge sur, von Dr. M. Friederichsen, 766 †
Gironde et le Golfe de Gascogne au XVI^e siècle, par A. Pawlowski, 766 †
Habitation sur les Plateaux limoneux du Nord de la France, par Prof. P. Vidal de la Blache, 392 †
"Landes," Beiträge zur Kenntnis der geographischen verhältnissemon, von Dr. M. C. Engell, 766 †; note on, 750
Maps: Carte Lithologique sousmarine des Côtes de France, par M. Thoulet, 113 †
Mesure de la méridienne de France, par Méchain, à la fin du XVIII^e siècle, par M. G. Bigourdan, 649 †
Nivellement Général de la France, par M. C. Lallemand, 393 †
Nouvelles constatations relatives à la contamination des résurgences des terrains calcaires en France, note de M. Martel, 649 †
Population de la France d'après les résultats du recensement de 1901, par V. Turquan, 649 †
Recensement de 1901 en France, par G. Cilvanet, 649 †
Réfection du Cadastre, et la Carte de France, par M. C. Lallemand, 393 †
Vulkanlandschaften Central-Frankreichs und die Spuren ihrer ehemaligen Vergletscherung, von Dr. M. Friederichsen, 649 †
Frandon, V. de, Du développement possible du Commerce entre la France et la Chine, 230 †
Franklin, J. H., La question de Libéria, 400 †
Franz-Josef Land—
Collembola from, by G. H. Carpenter, 531 †
Wellman'sche Polar-Expedition nach dem Kaiser-Franz-Josefs-Land, von G. R. v. Brosch, 779 †
Fraser, M. F. A., remarks on "From Shanghai to Bhamo," 276
Fraser, Rev. D., The Zulu of Nyasaland, 526 †
Frassi, Prof. H., La Nouvelle Cartographie Horaire, 405 †
Frech, Dr. F., Führer für die geologische Exkursion des XIII. Deutschen Geographentages nach Oberschlesien, 394 †

French Colonies—
Année Coloniale, par MM. Mourey et Brunel, 242 †
Atlas des Colonies Françaises, par P. Pelet, 247 †
Colonies Françaises, Un Siècle d'expansion Coloniale, par M. Dubois et A. Terrier, 783 †
Siècle d'expansion coloniale, par M. Dubois et A. Terrier, 242 †
Statistiques Coloniales pour l'Année 1899..534 †
Freshfield, D. W., The Glaciers of Kangchenjunga, 453 *; Mount Everest, or Jomokangkar, 653 †; remarks at the Geographical Association Meeting, 382
Fricker, Dr. K., Das Treibeis der antarktischen Meere, 404 †
Friederichsen, Dr. Max, Die Vulkanlandschaften Central-Frankreichs, 649 †; Beiträge zur geographischen Charakteristik der Bretagne, etc., 766 †; expedition to the Tian Shan, 754
Friedrich, E., Die Anwendung der Kartographischen Darstellungsmittel auf wirtschaftsgeographischen Karten, 534 †
Friquegnon, Commandant, Tonkin et Haut Laos, 786 †
Fritz, Bezirksamtmann, Bericht über die Insel Rota, 237 †
Froc, Père A., L'atmosphère en Extrême-Orient pendant les six mois froids, 653 †
Frosterus, B., Hufvudtyper inom de sydfinska landskapsformerna och berggrundens betydelse för uppkomsten af dem, 651 †
Fuchs, T., Die Verbreitung der Thierwelt im Bodensee, 522 †
Fuss, V. von, Tafel zur Berechnung der Höhe und des Azimuts der Gestirne, 405 †

G.

Gaiba laguna, Bolivia, 66
Galla countries, Baron Erlanger's expedition in the, 87
Galland, P., Dans le Kurdistan, 770 †
Gallieni, G., Le développement de Madagascar, 657 †
Gannett, H., The Population of the United States by Sex, Nativity, and Race, 402 †
Ganzenmüller, Dr. K., Statistik des sächsischen Elbverkehrs, 521 †
Garde, T. V., Die Verbreitung des Treibeises in den arktischen Meeren, 405 †
Gardiner, J. Stanley, award to, 630, 648; The Formation of the Maldives, 277 *; The Fauna and Geography of the Maldive and Laccadive Archipelagoes, 396 †
Garofalo, Prof. F. P., Sulla geografia delle *Gallie* sotto l'Impero Romano, 392 †; Studi di Geografia Greca, 392 †
Garstin, Sir W. E., Report upon the Administration of the Public Works Department, 232 †; note on, 507
Gascony—
Dünen und Landes der Gascogne, Aus den, von A. Engler, 766 †
Dunes and Landes of, The, 393 †
L'âge des Dunes et des étangs de Gascogne, par M. Saint-Jours, 392 †
"Landes of," Dr. M. E. Engell on the, 750
Gasnier, P., Thermomètres électriques de profondeur, 111 †
Gauss, the, arrival at Cape Town, 97
Gee, Mr., remarks on the "Teaching of Geography," 82
Geer, Prof. G. de, Die Gletscher von Spitzbergen, 405 †
Geikie, Sir A., The Use of Ordnance Maps in Teaching Geography, 662 †
Geikie, Prof. James, Mountains, 111 †, 780 †
Geissler, Dr. K., Die mathematische Geographie, etc., 238 †
Gelo river, Sobat region, 385; Gelo and Wellby's river, identification of the, 520
Gelodi, E. C., Sulla colonizzazione della Repubblica Argentina, 402 †
Geneva—
Hülfsmittel, Methoden und Resultate der Internationalen Erdmessung, Ueber die, von Dr. K. v. Orff, 779 †
Léman, Lake of, Le, Monographie Limnologique, par F. A. Forel, 767 †
Observatoire de Genève, Mémoire sur la latitude de l', par J. Pidoux, 104 †
Seiches de Genève, par Dr. F. A. Forel, 104 †
Genthe, Dr. S., Scientific Journey by, 383
Genthe, Martha K., German Geographers and German Geography, 112 †
Geodesy—
Erkenntniss der mathematischen Erdgestalt, Neuere Fortschritte in der, von Prof. F. R. Helmert, 405 †
Gestirne, Tafel zur Berechnung der Höhe und des Azimuts der, von V. von Fuss, 405 †
Jonction d'un réseau fermé de triangulation, note de P. Hatt, 110 †
Pendule à seconde en Russie, Sur les Observations du, par J. de Schokalsky, 405 †
Progrès de la géodésie, par A. Laussedat, 779 †
Geographic Conquests of the Nineteenth Century, by G. H. Grosvenor, 661 †
Geographical Association, Annual Meeting of the, 382
Geographical Congress—
Vœux émis par le 22e Congrès des Sociétés françaises de Géographie, 242 †
Geographical Cycle, The, by Prof. W. M. Davis, 407 †
Geographical Distances, A System of

Comparing, by Major F. J. S. Cleeve, 405 †
Geographical Exhibition—
Katalog der Ausstellung des XIII. Deutschen Geographentages zu Breslau, 242 †
Geographical Literature of the Month—
Africa, 106, 232, 397, 526, 654, 770
America, 108, 234, 400, 528, 658, 773
Anthropogeography and History, 239, 408, 533, 661, 781
Asia, 105, 229, 395, 524, 651, 768
Australasia and Pacific Islands, 236, 403, 530, 659, 776
Biography, 112, 240, 409, 534, 662, 782
Europe, 103, 227, 391, 521, 648, 765
General, 112, 241, 410, 534, 662, 782
Mathematical Geography, 110, 238, 405, 532, 660, 779
Physical and Biological Geography, 111, 238, 406, 532, 660, 780
Polar Regions, 110, 238, 404, 531, 660, 778
Geographical Names, Second Report of the United States Board on, 242 †; note on, 384
Geographical Progress—
Fortschritte der geographischen Forschungen und Reisen im Jahre 1900, von Oskar Lenz und Dr. E. Jung, 242 †
Geographical Publication, New German, 762
Geographical Society, A New Russian, 763
Geographical Teacher, first number of the, 98
Geography—
Antlitz der Erde, Das, von Ed. Suess, 111 †
Beziehungen zwischen Geographie und Geschichte, von Dr. K. Kretschmer, 410 †
Biologische Erdkunde im Schulunterrichte, von Dr. F. Höck, 241 †
Class Excursions in Wales and England, by J. B. Reynolds, 241 †
Commercial, A Text-Book of, by C. C. Adams, 408 †; review of, by G. G. Chisholm, 747
Day Schools, Geographical Teaching in, Limitations and Possibilities of, by C. Bird, 112 †
Dawn of Modern Geography, by C. R. Beazley, 240 †; review by E. J. Payne, 498
Deutschen Hochschulen, Geographische Unterricht an den, 242 †
Education, The Importance of Geography in, by Right Hon. J. Bryce, 301 *
Epoca delle grandi scoperte geografiche, by Prof. C. Errera, 661 †
Erde und das Leben, Eine vergleichende Erdkunde, von Dr. F. Ratzel, 242 †; review, 500
Factores que más han contribuido á
Geography—*continued.*
los descubrimientos geográficos, por General I. Cucalón, 661 †
German Geographers and German Geography, by Martha K. Genthe, 112 †
Humanismus in seinem Einfluss auf die Entwickelung der Erdkunde, von Dr. S. Günther, 409 †
Journal of Geography, edited by Profs. Dodge and Lehnerts and Dr. Goode, 383
Lage im Mittelpunkt des geographischen Unterrichts, von Dr. F. Ratzel, 241 †
Maps in Geography Teaching, The Use of, by A. W. Andrews, 241 †
Mathematische Geographie in ihrer Mittelstellung als empirische und mathematische Wissenschaft, von Dr. K. Geissler, 238 †
New Basis of, by J. W. Redway, 410 †; review of, 368
Ordnance Maps, The Use of, in Teaching Geography, by Sir A. Geikie, 662 †
Organization des geographischen Unterrichts nach den neuen Lehrplänen, von Dr. H. Wagner, 783 †
Oxford School of, Report, 643
Physical: Relation of, to other science subjects, by W. H. Norton, 111 †; Lessons in, by C. R. Dryer, 239 †; review of, 629
Relations of Geography and History, by Rev. H. B. George, review of, by Jas. Bryce, 627
Teaching of, by R. S. Tarr, 783; † Conference on, at the London School Board, 81; Methods of, by T. G. Rooper, 241 †
Universität Breslau, Geographie an der, von Dr. J. Partsch, 241 †
Verknüpfung der physischen mit der politischen Landeskunde im Schulunterricht, von Dr. Langenbeck, 783 †; ditto, von Dr. Kirchhoff, 783 †
Zoogeographischer Studien, Ueber Zweck und Methode, von E. Hartert, 242 †
Geologic Mapping, The Formation as the Basis for, by E. C. Eckel, 660 †
Geological Time, The Circulation of Salt and, by Prof. J. Joly, 238 †
Geology—
History of Geology and Palæontology, by K. A. von Zittel, 406 †
Student's Handbook of Stratigraphical Geology, by A. J. Jukes-Browne, 660 †
Vorpontische Erosion, von R. Hoernes, 660 †
George, C., The Rise of British West Africa, 771 †
George, Louis, Une excursion à travers le Mexique, 401 †
George, Rev. H. B., The Relations of Geography and History, review of, by Jas. Bryce, 627

Gerlache, Commandant de, Voyage de la *Belgica*, 778 †
Gerland, Dr. G., Die italienischen Erdbeben und die Erdbebenkarte Italiens, 650 †; Verteilung der Erdbebenthätigkeit in Italien nach M. Baratta, 244 †
German Colonies—
Deutsches Kolonial-Handbuch. Nach amtlichen Quellen bearbeitet von Dr. Fitzner, 534 †
Jahresbericht über die Entwickelung der deutschen Schutzgebiete, 783 †
German Methods of Development in Africa, by C. T. Hagberg Wright, 399 †
Maps: Grosser Deutscher Kolonialatlas, von P. Sprigade und Max Moisel, 116 †
Meteorologische Beobachtungen aus den Deutschen Schutzgebieten, von Prof. Dr. K. Dove, 112 †
Unsere Kolonien im Jahre 1900, von Dr. Hillemanns, 112 †
German Geographers and German Geography, by Martha K. Genthe, 112 †
German Hydrographical Office—
Dreiundzwanzigster Jahresbericht über die Thätigkeit der Deutschen Seewarte, 242 †
German Scientific Publication, A New, 762
Germany—
Aenderung der Temperatur von Tag zu Tag an der deutschen Küste, von Dr. Grossmann, 522 †
Arabischen Tauschhandel in Norddeutschland, 393 †
Briquetagegebiet von Vic, Deutsch-Lothringen, von Dr. J. Marcuse, 393 †
Deutschen Seehandelsstädte, Die wichtigsten, von Dr. R. Reinhard, 650 †
Deutschland auf den Hochstrassen des Weltwirtschaftsverkehrs, von A. Dix, 393 †
Einsturzbecken im nord-westlichen Thüringen und in der Vorderrhön, von Dr. W. Halbfass, 650 †
Geographieunterricht an den preussischen höheren Schulen und die Juni-konferenz, von Dr. H. Fischer, 227 †
Geographische Unterricht an den deutschen Hochschulen, 242 †
Glacial Bildungen des nord-deutschen Flachlandes, von Dr. F. Wahnschaffe, 393 †
Kartographie von Deutschland, Die Anfänge der, von Dr. Sophus Ruge, 393 †
Litteratur zur deutschen Landeskunde Bericht über die neuere, von Dr. A. Kirchhoff und Dr. K. Hassert, 766 †
Maps: Karte von Hinterpommern zur Uebersicht derjenigen in 1899 und 1900, von Dr. W. Halbfass, 244 †;
Germany—*continued.*
Karte des Deutschen Reiches (Kon. Preuss. Landes-Aufnahme), 244 †, 411 †; Radfahrer-Uebersichtskarte von Deutschland und den benachbarten Ländern, von P. Krauss, 113 †, 535 †
Memel-, Pregel- und Weichselstrom, von Dr. J. Partsch, 394 †
Riesengebirga-Exkursion des XIII. Deutschen Geographentages, von Dr. Max Friederichsen, 522 †
Southern: Handbook for Travellers, by Karl Baedeker, 649 †
Verlauf der diluvialen Eiszeit in Schwaben, von Dr. W. Götz, 650 †
Volk und Land der Deutschen vom 10. bis zum 13. Jahrhundert, Bezeichnungun für, von F. Vigener, 650 †
Waldbäume in Deutschland, Verbreitung der wichtigsten einheimischen, von Prof. Dr. Hans Hausrath, 227 †
Wassererwerbs-Bevölkerung im Deutschen Reiche, von P. Langhans, 393 †
Gervais-Courtellemont, Vandelet, and others, Empire Colonial de la France, L'Indo-Chine, Cochinchine, etc., 524 †
Gesenke, Das, Eine Passstudie, von Dr. R. Fox, 103 †
Ghose, N. N., Memoirs of Maharaja Nubkissen Bahadur, 782 †
Giberne, Miss Agnes, The Mighty Deep, and what we know of it, 239 †; review of, 365
Giesenhagen, Dr. K., Auf Java und Sumatra, 769 †
Gilbert and Ellice Islands, Report for 1896–1900 (Colonial Rep.), 237 †
Gill, —, Report of His Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty, 398 †
Gipps, F. B., Lake George as a Site for the Federal Capital of Australia, 403 †
Girard, B., L'île de Mételin, 523 †
Glacial Epoch—
Climat des temps glaciaires, A propos de la question du, par H. Arctowski, 532 †
Glacial Erosion—
Gegenwärtige Standpunkt der Lehre von der Glacial-Erosion, von Dr. S. Günther, 661 †
Glaciation, meaning of term, 389
Glaciers—
Bedding, Foliation, and Movement of Glacier Ice, Prof. Hans Crammer's observations on, 512
Beitrag zur Gletcherkunde der Tropen, von Dr. H. Meyer, 780 †
Erscheinungen, welch einem Gletschervortoss vorausgehen, von Dr. S. Finsterwalder, 780 †
Ice-grain in Glaciers, The size of, by J. Y. Buchanan, 111 †
Length of Glaciers, Variations in the, M. Ch. Rabot on, 194

Glaciers—*continued.*
Of Kangchenjunga, by W. D. Freshfield, 453 *
Variations périodiques des Glaciers, par Dr. Finsterwalder et E. Muret, 407 †
Glauning, Lieut., and Dr. Kohlschütter, Pendulum Expedition to East Africa, 639
Gleig, Ch., A Village in the New Forest, 651 †
Globe—
Globigerina ooze of deep-sea deposits, 693, 697, 706, 707
Globus Biblioteki Jagiellońskiej z początku XVI., by T. Estreicher, 409 †
Gobi—
Desert du, A travers le, par R. P. Verwilghen, 230 †
Russian explorations in the, 580, 581, 597
Gold—
Or dans le Monde, par J. Servigny, 534 †
Verbreitung des Goldes auf der Erde, 239 †
Gold Coast—
Côte d'Or comme pays aurifère, par E. Perregaux, 107 †
Map of, with part of Ashanti and the Ivory Coast, by H. Wallach, 665 †
Surveys in, 376
Goodwin, H. B., Longitude by Equal Altitudes, 660 †
Gordon, G., Did De Quiros land at Port Curtis? 530 †
Gordon, G. L., account of Forty-mile, Yukon Territory, 640
Gordon, Mrs. Ogilvie, The Crust-Basins of Southern Europe, 395 †
Gormaz, F. V., Depressions and Elevations of the Southern Archipelagoes of Chile, 775 †
Götzen, A. Graf von, Ueber die neuesten Forschungen im Gebiet der Nil-Quellen, 398 †
Graham, R. B. C., A Vanished Arcadia, being some account of the Jesuits in Paraguay, 403 †
Graham Land, Antarctic, 761
Grandidier, A., Histoire physique, naturelle et politique de Madagascar, 657 †; Histoire de la découverte de l'île de Madagascar, 772 †
Grandidier, G., journey in Southern Madagascar, 90
Great Bear Lake Region, Photographs of the, by J. Macintosh Bell, 119 †
Great Salt Lake, The, by Prof. J. E. Talmage, 529 †
Greece—
Eisenbahnen Griechenlands, Zur Geschichte der, von A. Struck, 650 †
Great Persian War and its Preliminaries, by G. B. Grundy, 227 †
Greely, Brigadier-General A. W., Progress Map of Signal Corps Telegraph Lines . . . in the Philippines, 664 †
Green, Mrs J. R., (Biography of) Mary Kingsley, 409 †
Greenland—
Dänischen Expedition nach Ost-Grönland, by Lieut. Amdrup, 779 †
Dänischen Expedition nach Ost-Grönland, Die Schiffsreise der, by Dr. N. Hartz, 779 †
Danish expedition to, 641
East: Botanical expedition to, under Dr. Kruse, 379
Expeditions, Peary's, 96
North-East, and König Karl Land, Prof. Nathorst's observations on the Geology of, 510
Två Somrar i Norra Ishafvet, af A. G. Nathorst, review of, 80
Gregory, Hon. A. C., On the Mitigation of Floods in the Brisbane River, 237 †
Gregory, Prof. J. W., Antarctic Exploration, 660 †; expedition to Lake Eyre, 377, 509, 607; The Foundation of British East Africa, 526 †
Grenfell, W. T., Life in Labrador, 529 †
Grey, G., Photographs of Northern Rhodesia, 120 †
Griesbach, C. L., General Report . . . of the Geological Survey in India, 230 †
Groffier, V., Explorations des . . . Missionnaires Catholiques, 783 †
Grossmann, Dr., Die Aenderung der Temperatur von Tag zu Tag an der deutschen Küste, 522 †
Grosvenor, Prof. E., Siberia, 106 †
Grosvenor, G. H., The Geographic Conquests of the Nineteenth Century, 661 †
Grund, Dr. A., Die Veränderungen der Topographie im Wiener Walde und Wiener Becken, 648 †
Grundy, G. B., The Great Persian War and its Preliminaries, 227 †; review of, 360
Guadeloupe, On the Geological and Physical Development of, by Prof. J. W. Spencer, 236 †
Guapore, L'exploitation du haut, 402 †
Guatemala—
Alta Verapaz, Die, von Dr. K. Sapper, 775 †
Deutschtum in Guatemala, Das, von H. Buhle, 402 †
Wissenschaftliche Ergebnisse einer . . . Reise durch Mexico und Guatemala, von Dr. E. Seler, 775 †
Guayaquil, railway to Quito from, 315
Guénin, E., La Russie, Histoire, Géographie, Littérature, 228 †
Guffroy, M., Carte de la Guyane Française, 246 †
Guiana—
Brazilian: La Rivière Vincent Pinzon. Étude sur la cartographie de la Guyane, par P. Vidal de la Blache, 659 †
British: Geographical Results of the Venezuela-British Guiana Boundary Dispute, by M. Baker, 403 †

Guiana—*continued.*
Dutch: Suriname Expeditie, 236 †; Koppename Expedition in, 758
French: Carte de la Guyane Française, par M. Guffroy, 246 †; Les Mines et l'industrie minière de la Guyane française, rapport de M. Hoarau-Desruisseaux, 110 †; Richesses de la Guyane Française et de l'ancien Contesté Franco-Brésilien, par G. Brousseau, 236 †
Peuples autochtones des Guyanes, Note sur les, par M. Guffroy, 776 †
Guillot, E., Les Européens dans l'Asie Orientale, 230 †
Guinea—
French: La Guinée française et le Fouta-Djalon, par M. Noirot, 399 †
Gunong Tahan, Ascent of, by Mr. J. Waterstradt, 213
Günther, Dr. S., Akustisch-Geographische Probleme, 406 †; Der gegenwärtige Standpunkt der Lehre von Glacial-Erosion, 661 †; Der Humanismus in seinem Einfluss auf die Entwickelung der Erdkunde, 409 †
Gurg, Persia, 159
Gurrundu, ruin of, Morocco, 191
Gutzwiller, A., Zur Altersfrage des Löss, 523 †
Gwádur, Makrán, 128
Gwynn, Major C. W., Surveys on the Proposed Sudan-Abyssinian Frontier, 656 †

H.

Haddon, A. C., Head-Hunters, Black, White, and Brown, 654 †
Haeckel, E., Aus Insulinde. Malayische Reisebriefe, 654 †
Haëuke, T., Descripcion del Peru, 403 †
Hagenbach-Bischoff, Prof. E., Vermessungen am Rhone-Gletscher während 25 Jahren, 395 †
Haggard, H. Rider, A Winter Pilgrimage, 242 †
Haines, C. W., Remarks on the Earthquake in the State of Colima, Mexico, 234 †
Haiti—
Geologie Haïtis, Beiträge zur, von L. G. Tippenhauer, 402 †
Halbfass, Dr. W., Beiträge zur Kenntnis der Pommerschen Seen, 227 †; note on, 381; Einige Kapitel aus der modernen Seenforschung, 532 †; Karte von Hinterpommern zur Uebersicht derjenigen in 1899 und 1900..244 †; Systematische internationale Seenforschung, 407 †; Ueber einige Einsturzbecken im nordwestlichen Thüringen und in der Vorderrhön, 650 †
Hall, D. B., and Lord A. Osborne, Sunshine and Surf. A Year's Wanderings in the South Seas, 237 †
Hall, R. N., and W. G. Neal, The Ancient Ruins of Rhodesia, 772 †; review of, 495
Hall, W., Longitude by Equal Altitudes near Noon at Sea, 660 †
Halle, Dr. von, Die Vertheilung der Industrie auf die klimatischen Zonen, 409 †
Hallion: *see* Tissot
Hammarström, R., Om strandbildningar och marina gränsen i södra österbotten och angränsande trakter, 651 †
Hammer, Dr. E., Der Hammer-Fennel'sche Tachymeter-Theodolit, etc., 660 †; Die Messungsmethoden der chilenischen Grenzkommission, 530 †
Hámun i Helmand, 143, 145
Hamy, Dr. E. T., Publications Scientifiques de, 662 †
Han tributary of the Yang-tse, 712
Hann, J., Die Meteorologie von Wien, 103 †
Hannington, Lake, Uganda Protectorate, 8
Hansen, R., Rüstringen und Wangerland am Jadebusen, 535 †
Harnack, A., Vorstudie zu einer Geschichte der Verbreitung des Christenthums in den ersten drei Jahrhunderten 409 †
Harpoot, Turkey in Asia, The Climate of, by Prof. E. Huntingdon, 106 †
Harris, Captain, and Commander Havergal, Tide Tables for British and Irish Ports, 229 †
Harrisse, H., Découverte et Évolution Cartographique de Terre-Neuve et des pays circonvoisins, 234 †; review of, 625
Hartert, E., Ueber Zweck und Methode zoogeographischer Studien, 242 †
Hassert, Dr. Kurt, Gletscherspuren in Montenegro, 650 †; Reise durch Montenegro im Sommer 1900..228 †; und Dr. A. Kirchhoff, Bericht über die neuere Litteratur zur deutschen Landeskunde, 766 †
Hatt, P., Jonction d'un réseau fermé de triangulation, 110 †
Haupt, L. M., Methods of Improving Ocean Bars, 534 †; Obstructions to Commerce, and how to remove them, 239 †
Hauran, Notes of a Journey through, by Prof. G. A. Smith, 232 †
Hausa Notes, by W. R. Miller, 657 †
Hausrath, Prof. Dr. Hans, Die Verbreitung der wichtigsten einheimischen Waldbäume in Deutschland, 227 †
Hauthal, R., Contribuciones al Conocimiento de la Geologia de la Provincia de Buenos Aires, 402 †
Hauttecœur, H., L'Ile de Karpathos, 231 †; L'Ile de Kimolos, 650 †; L'île de Symi, 397 †
Hawaiian Islands—
Maps: Indexed Pocket Map of the (Rand, McNally & Co.), 537 †
Haydon, Dr. A., remarks on the "Ancient Kingdom of Kongo," 559

Hayford, Rev. M. C., Mary H. Kingsley from an African Standpoint, 534 †
Hazelius, Dr. A. I. (Biography), 241 †
Head-Hunters, Black, White, and Brown, by A. C. Haddon, 654 †
Hearson, T. A., A Comparison of the Flow of Water in a River with that in a Small-Scale Model of the River, 408 †
Hector, Sir J., Early Explorations and Colonisation of Western Canada, 658 †
Hedin, Dr. Sven, Journey across Tibet, 85, 502
Heiderich, Dr. F., Hölzel's Schulwandkarte von Asien, 785 †
Heiderich, Dr. J., Das Wachstum Englands, 662 †
Hein, Dr., Expedition to Southern Arabia, 370
Hellmann, Dr. G., Regenkarte der Provinzen Brandenburg und Pommern, 393 †; note on, 501; und W. Meinardus, Der grosse Staubfall von Marz, 1901, in Nordafrika, etc., 780 †
Helmand river, Persia, 142, 632
Helmert, Prof. Dr. F. R., Neuere Fortschritte in der Erkenntniss der mathematischen Erdgestalt, 405 †
Henjám, Persian gulf, 127
Henkel, Dr. L., Die Grenze der Sichtbarkeit des Landes auf dem Mittelmeer, 244 †, 650 †; note on, 502
Henning, Dr. G., Samuel Braun aus Basel der erste deutsche wissenschaftliche Afrikareisende, 773 †
Hensman, H., Cecil Rhodes, A Study of a Career, 782 †
Hérault, P., Les Ressources minières de Madagascar, 657 †
Herbertson, F. D., Descriptive Geographies from Original Sources. North America, 401 †
Herbertson, Dr., remarks on the "Teaching of Geography," 81
Héron, Lieut., Hydrographical Expedition to Indo-China, 214
Herrmann, Hauptmann, Die Kivu Vulkane, 526 †; note on, 217
Hertfordshire Maps, by H. G. Fordham, 523 †
Hertz, M., expedition to the mammoth in Kolymsk, 215
Hervé, M., Note sur des observations de mirage, 780 †
Hesse-Wartegg, E. von, Samoa, Bismarckarchipel und Neuguinea, 778 †
Hetherwick, Rev. A., A Practical Manual of the Nyanja Language, 655 †; A Handbook of the Yao Language, 655 †
Hettner, Dr. A., Ueber bevölkerungsstatistische Grundkarten, 409 †
Heywood, Rev. J. W., A Holiday in Japan, 231 †
Hiekisch, Dr. C., Catalogue des données hypsométriques de la Russie d'Asie, 769 †
Hierapolis, von W. Borée, 770 †
Hiern, W. P., Catalogue of the African Plants collected by Dr. F. Welwitsch, 773 †
Hilgard, E. W., Characteristics of Soils in the Arid Regions, 406 †
Hill, R. T., The Coast Prairie of Texas, 402 †
Hillemanns, Dr., Unsere Kolonien im Jahre 1900..112 †
Himalayas—
Across the Himalayas in Mid-Winter, by the Earl of Ronaldshay, 230 †
Attraction of the, upon the Plumb-line in India, by Major Burrard, review of, by E. A. Reeves, 615
Glaciers of Kangchenjunga, 457
Hinde, Sydney L. and Hildegarde, The Last of the Masai, review of, 200
Hindustani Self-taught with English Phonetic Pronunciation, by C. A. Thimm, 783 †
Hirschberg and Oestergaard, Map of the British Isles, 243 †
History—
Relations of Geography and, by Rev. H. B. George, review of, by Jas. Bryce, 627
Hitchcock, F. H., Distribution of the Agricultural Exports of the United States, 109 †
Hitier, H., L'évolution de l'agriculture, 533 †
Hoang-Ho, lakes of the upper, 585
Hobbs, W. H., The River System of Connecticut, 235 †; note on, 91
Hobley, C. W., on the Kósova tribe, 4
Höck, Dr. F., Die biologische Erdkunde im Schulunterrichte, 241 †
Hoernes, R., Die vorpontische Erosion, 660 †
Höfler, Prof. Dr., Die Entstehung des Föhns, 111 †
Hogarth, D. G., The Nearer East, 783 †
Hohler, T. B., Report on the Oasis of Siva, 232 †
Holder, C. F., A remarkable Salt Deposit, 529 †
Holdich, Colonel Sir Thomas, remarks on: "A Fourth Journey in Persia," 169; "The Formation of the Maldives," 296, 301; "Glaciers of Kangchenjunga," 472; review of Wilson's "Topographic Surveying," 75
Holland—
Description géographique de la Hollande au sud du Lek et de la nouvelle Meuse, au moyen âge, par J. Van Baren, 650 †
Groenlosche Slinge en haar stroomgebied boven het dorp Winterswijk, door F. E. L. Veeren, 228 †
Nomina Geographica Neerlandica uit een geographisch oogpunt beschouwd, door A. A. Beekman, 650 †
Hollis, Claud, Notes on the History and Customs of the People of Taveta, 398 †
Holm, H., Die Flora der "ewigen Schnee- und Eis- Region," 405 †

Holtze, M. W., on the Agricultural Capabilities of the Northern Territory, South Australia, 378
Holub, Dr. E., obituary of, 517
Homén, T., Om skogarnas inflytande på Finlands Klimat, 651 †
Hong Kong—
Photographs of, by H. C. Hurley, 540 †
Plan of the City of Victoria, 786 †
Report on Operations in the New Territory (Colonial Rep.), 652 †
Hormuz, Persian gulf, 123, 126
Hourst, Lieut., Ascent of the Yang-tse Rapids, 214
Hourtin et de Lacanau, Au Sujet des eaux de, par M. Saint-Jours, 392 †
Howchin, W., Preliminary Note on the Existence of Glacial Beds of Cambrian Age in South Australia, 237 †; Notes on the Extinct Volcanoes of Mounts Gambier and Schank, 238 †; On the Origin of the Salt Lagoons of Southern Yorke Peninsula, 238 †
Howorth, Sir H. H., The Earliest Traces of Man, 239 †; remarks on "A Fourth Journey in Persia," 172
Hubbard, G. D., Fiords, 532 †
Hudson, A. E. L., A Geography of Wales intended chiefly for use in Welsh Schools, 651 †
Hudson Bay Region—
Exploration in the Country between Lake St. John and James Bay, Report of Progress of, by H. O'Sullivan, 234 †; note on, 91
Huet, C., Histoire de l'occupation du territoire des Antaimorona, 657 †
Hughes, Prof. T. McK., Ingleborough. Part i. Physical Geography, 105 †; note on, 501
Huguet: *see* Simian
Hull, Prof. E., On the Physical History of the Norwegian Fjords, 394 †
Human Culture, Environment in Relation to Sex in, by Prof. O. T. Mason, 782 †
Hu-nan province, China, 714, 716, 725; coal and tea trade, 729; timber, manufactures, and architecture, 730
Hungary—
Plaine hongroise: Alföld et Puszta, par M. l'abbé L. de Lacger, 522 †
Ungarischen warmen und heissen Kochsalzseen als natürliche Wärmeaccumulatoren, von A. v. Kalecsinsky, 522 †
Huntingdon, E. & G. H., G. P. Knapp, P. Ward, photographs of the gorges of the Euphrates and neighbourhood, 788 †
Hurley, H. C., Photographs of Hong Kong, 540 †
Hutchinson, H. N., J. W. Gregory, and R. Lydekker, The Living Races of Mankind, 533 †
Hutter, D., Der westafrikanische Bantuneger, 658 †
Hyatt, S. P., account of the Ndauga District of Mashonaland, 635
Hydrography—
Idrografiá e la Navigazione, Raccolta di Documenti e Notizie circa l', 406 †

I.

Iba, settled population of, Tibet, 590
Ice Age—
Divisions of the Ice Age, by W. Upham, 661 †
Einige Worte über die Eiszeit, von Dr. E. Roth, 661 †
Ice Caves and Frozen Wells, by W J McGee, 532 †; Ice Caves and Frozen Wells as Meteorological Phenomena, by Kimball, 407 †; note on, 220
Ice, Density . . . of Cubical Expansion of, by J. H. Vincent, 780 †
Iceland—
Iceland and the Icelanders, by J. R. Newby, 228 †
Islandske Fjorde og Bugter, af Dr. T. Thoroddsen, 394 †; note on, 612
Maps: Geological Map of, by T. Thoroddsen, 411 †
Moræner i den islandske Palagonitformation, af H. Pjetursson, 522 †
Idaho, Indexed County and Township Pocket Maps of (Rand, McNally & Co.), 537 †
Idiaquez, E., Linea geodésica Madera-Yavary, 659 †
Iglesias, Captain A. R., survey of the Rio Santa Cruz, 94
Ignatov, M., Exploration of Lake Telezkoie in the Altai, 370
Illinois, Indexed County and Township Pocket Maps of (Rand, McNally & Co.), 787 †
Immanuel, Hauptmann H., Die Goldgebiete zu beiden Seiten der Beringstrasse, 787 †; Die Landschaft Kwantung im russischen Besitze, 768 †
Inambari River and Neighbourhood, Photographs of the, 668 †
India—
Artesian Experiments in, Recent, by E. Vredenburg, 396 †; note on, 212
Census of, 1901, First Total, 524 †
Coal Resources of, Prof. Dunstan on the, 752
First English Map of, by C. G. Cash, 653 †
Geological Survey of, General Report on the work of the, by C. L. Griesbach, 230 †
Maps: Government Surveys, 412 †, 664 †
Nederlandsche Factorijen in vóór-Indië in den aanvang der 19e eeuw, door P. H. van der Kemp, 653 †
Plumb-line in, Attraction of the Himalaya Mountains upon the, by Major S. G. Burrard, review of, by E. A. Reeves, 615

India—*continued*.
Railways in, Administration Report, 230†; note on, 213
Route from the Indus to the Kashmir Valley, Major Bretherton's exploration of a, 631
Vertebrate Animals of, Distribution of, by W. T. Blanford, 524†; note on, 633
Viaggio di Matteo da Bergamo in India sulla flotta di Vasco da Gama, del P. Peragallo, 653†
Indo-China—
French: En Indo-Chine, du Sous-Sol, par M. J. Marc Bel, 524†; Empire Colonial de la France, L'Indo-Chine, Cochinchine, etc., par Gervais-Courtellement, Vandelet, and others, 524†
Hydrographical Expedition under Lieut. Héron, 214
Maps: Atlas Archéologique de l'Indo-Chine, par Captain E. Lunet de Lajonquière, 412†; Carte de l'Indo-Chine (Bureau Top. des Troupes de l'Indo-Chine), 115†
Mékong voie de pénétration, par Xieng-La, 769†
Possibilités économiques de l'Indo-Chine, par P. Padaran, 769†
Voyage d'une Française dans L'Indo-Chine, par J. Leclercq, 525†
Indus—
New Route from the Indus to the Kashmir Valley, Major Bretherton's exploration of a, 631
Industries—
Vertheilung der Industrie auf die klimatischen Zonen, von Dr. von Halle, 409†
Ingleborough, physical geography of the neighbourhood of, Prof. Hughes on, 501
Inhambane, Trade of (Foreign Office Rep.), 233†
Insalah—
Position géographique d'In-Salah, par G. B. M. Flamand, 528†; note on, 375
Interglacial Periods, The Relation of Changes of Level to, by Prof. A. P. Coleman, 661†
International Student's Atlas of Modern Geography, 665†
Interoceanic Communication on the Western Continent, by Colonel G. E. Church, 313*
Irazú volcano, Costa Rica, 318
Ireland—
Botany, Irish Topographical, by R. L. Praeger, 104†; note on, 630
Gold in co. Wicklow, etc., Prospecting for, by E. St. John Lyburn, 523†
Prehistoric Remains from the Sandhills of the Coast of Ireland, Report on the, by W. J. Knowles, 523†
Irkutsk, altitude of, 634
Iron Gate: *see* Danube
Iseran, Mont, La Légende du, by W. A. B. Coolidge, 391†
Isfahán, Persia, 135
Islands and Oases: *see* Oases
Istria, Lussino, Isola dell', by Prof. L. Czink, 765†
Italy—
Bathometric der Italienischen Seen, von Dr. G. de Agostini, 394†
Guide to (Macmillan & Co.), 228†; review of, 366
Italienischen Erdbeben und die Erdbebenkarte Italiens, von Prof. Dr. G. Gerland, 650†
Laghi italiani, Lo studio delle sesse nei, per O. Marinelli, 522†
Maps: Verteilung der Erdbebenthätigkeit in Italien nach M. Baratta, von G. Gerland, 244†
"Mistpoeffers" italiani, A proposito dei, del M. Baratta, 650†
Popolazione del Regno d'Italia secondo i risultati del Censimento generale, del E. Raseri, 228†
Umbrian Towns. Grant Allen's Historical Guides, by J. W. and A. M. Cruickshank, 394†
Ivanoff and Batsévich, MM., description of the Sikhota-alin, 215
Ivory Coast—
Côte d'Ivoire, À la: La Sassandra, par M. G. Thomann, 399†
Haute Côte d'Ivoire occidentale, par M. van Cassel, 233†
Maps: Carte de la Côte d'Ivoire, par A. J. Bourdariat, 413†
Populations Anthropophages du Cavally, par Captain D'Ollone, 399†

J.

Ja river, Kamerun, 219
Jaap, W., Marokko, 657†
Ja-chu river, 587
Jack, Dr. Logan, remarks on the "Artesian Water-supply of Australia," 575; From Shanghai to Bhamo, 249*
Jacqmin, L., Macao, 396†
Jaeger, J., Das Bozener Land, 391†
Jamaica—
And the Imperial Direct West India Mail Service, by T. Rhodes, 776†
Handbook of Information for Intending Settlers, with Notes for Visitors, 530†
Handbook of, for 1902. Compiled by T. L. Roxburgh and J. C. Ford, 776†
Jamaica, by H. T. Thomas, 776†
Jan Mayen—
Flora der Insel Jan Mayen, Beiträge zur, von P. Dusén, 531†
Jannasch, Dr. R., Karte von Südbrasilien, 115†
Japan—
Dreiunddreissig Jahre in Ost-Asien, von M. von Brandt, 231†

Japan—*continued.*
Erdbebenforschung in Japan, von Dr. N. Yamasaki, 231 †
Fish Fauna of, by President D. S. Jordan, 231 †
Foreign Trade and Shipping of (Foreign Office Rep.), 654 †
Grammatik der Japanischen Umgangssprache, von A. Seidel, 396 †
Holiday in, by Rev. J. W. Heywood, 231 †
Jaquet, J. B., The Iron Ore Deposits of New South Wales, 237 †; note on, 94
Java—
Auf Java und Sumatra, von Dr. K. Giesenhagen, 769 †
Conquest of, by Captain R. G. Burton, 654 †
De uitbarsting van 1593: Raun of Ringgit? door F. J. Niermeyer, 654 †
Jennings-Bramly, W., A Journey from Farafra to Siwa, 1898..73 *
Jesup expedition to North-Eastern Siberia, 215
Jibuti, Count Wickenburg's journey from, to Lamu, 216
Joalland, Captain, Autour du Tchad, 528 †
Johnston, Sir Harry, The Uganda Protectorate, Ruwenzori, and the Semliki Forest, 1 *; Notes on African Subjects of Special Interest, 398 †; The Protectorates of Great Britain in Tropical Africa, 655 †
Johnston, W. & A. K., Special Map of South Africa, 536 †; The Victoria Regina Atlas, 116 †
Joko: *see* Kamerun
Joly, Prof. J., The Circulation of Salt and Geological Time, 238 †; On the Inner Mechanism of Sedimentation, 532 †
Jongri, Himalayas, 471
Jonsong La, Kangchenjunga, 456
Jordan, President D. S., The Fish Fauna of Japan, 231 †
Jordan—
Notes on a Cross Jordan Trip, by Rev. J. B. Nies, 232 †
Juan de Nova et Europa, par P. de Kadoré, 398 †
Jukes-Browne, A. J., The Student's Handbook of Stratigraphical Geology, 660 †
Jung, Dr. E., Fortschritte der geographischen Forschungen und Reisen im Jahre 1900. Australien und die Südsee, 242 †

K.

Kabru, Himalayas, 471
Kachin tribes and villages, 272
Kadei river, Sanga basin, 756
Kafue and Zumbo Districts, Journey to the, by P. H. Selby, 605 *
Káin, district of, Persia, 149, 152
Kala, Lake Tanganyika, 599
Kalahari—
Hydrographie des nördlichen Kalahari-Beckens, von Dr. S. Passarge, 400 †
Kala-i-Sang, or Kala-i-Beiza, Persia, 165
Kala Zarri, Persia, 155
Kalgoorlie, Topographical Map of, based on Tacheometric Surveys, by W. D. Campbell and the late S. J. Becher, 665 †
Kamasia tribe, Uganda Protectorate, 9
Kambachen, Himalayas, 470
Kamchatka, Jesup expedition in, 215
Kamennye islands, Arctic ocean, 477
Kamerun—
Astronomische Ortsbestimmungen in Kamerun, von Prof. M. Schnauder, 656 †
Bakwirivolk in Kamerun, von A. Siedel, 233 †
Begleitworte zu der Karte "Die Flussgebiete des Mungo und Unteren Wuri," von M. Moisel, 657 †
Eisenbahn Victoria-Mundame, Zur, von Dr. A. Schulte, 399 †
Expedition des Freiherrn v. Stein, 399 †, 657 †; notes on, 218, 638
Expedition des Hauptmanns v. Schimmelpfennig von Ngutte II. nach Yabassi, Bericht über die, 233 †
Frontière entre le Cameroun et le Congo, Une violation de la, 400 †
Höhenmessungen von Dr. Esch in Kamerun, von Dr. v. Danckelman, 656 †
Joko, Bereisung des Gebietes südlich und südöstlich von, 107 †
Land- und Völkerkunde von Kamerun-Hinterland, von G. Spellenberg, 657 †
Maps: Reisewege des Presbyterianer-Missionars Alexander Ross von Alt-Kalabar ins Kamerun Gabiet, von P. Langhans, 786 †
Reise ins N.-W.-Gebiet des Hinterlandes von, Bericht über meine, von G. Spellenberg, 107 †
Stationsanlage am Crossfluss, 400 †
Kämmerling, P., Georg B. Mendelssohn und Seine Schilderung des Riesengebirges, 241 †
Kan, Dr. C. M., Die neuesten Fortschritte der Kenntnis von Sumatra, 769 †
Kan tributary of the Yang-tse, 712
Kangchenjunga, The Glaciers of, by D. W. Freshfield, 453 *
Kang-wha, by Rev. M. N. Trollope, 654 †
Kant-Laplacesche Hypothese und die Geographie, von Prof. Dr. F. Ratzel, 406 †
Kara Sea—
Exploration of the, Russian, 378
Karema, Lake Tanganyika, 599
Karpathos, L'Ile de, par H. Hautteœur, 231 †
Kasai, Upper, survey of the, by Mr. F. Schindler (with map), 505
Kasama, British Central Africa, 604

Kashmir—
Pir Punjal Range and Tatticooti in, by Dr. E. F. Neve, 653 †
Valley, route from the Indus to the, 631
Katanga—
Grottes et Troglodytes du Ka-Tanga, par Captain C. Lemaire, 655 †
Mission Scientifique du, par Captain C. Lemaire, 526 †, 527 †
Kati-Bamako, Région, par Lieut. Calisti, 246 †
Katzer, Dr. F., Die ehemalige Vergletscherung der Vratvica planina in Bosnien, 391 †
Kaulun, Plan of (Public Works Dep.), 245 †
Kavirondo bay, Victoria Nyanza, 12
Kaznakoff, M., explorations in Tibet, 577, 578
Keane, Prof. A. H., The Gold of Ophir, Whence brought and by Whom? 409 †; review, 361; Central America and West Indies; review of, by Colonel G. E. Church, 622
Kearney, Lieut. T. A., Uniform Systems of Buoyage as adopted by various Maritime Nations, 787 †
Keilhack, Dr., Zur Geologie und Morphologie der Umgebung Stettins, 522 †
Keis, island of, Persian gulf, 59
Keller, Dr. C., Die landwirtschaftlichen Zustände im afrikanischen Osthorn, 657 †
Kendall, P. F., and H. B. Muff, Evidences of Ancient Glacier-dammed Lakes in the Cheviots, 229 †
Kennedy, A. B. W., The Alps in 1864, by A. W. Moore, edited by, 765 †
Kennelly, —, The Atlantic Ferry: Louisburg and Milford Haven, 239 †
Kentucky, Photographs of, by Miss Semple, 120 †
Kerguelen Island—
Aussprache des namens Kerguelen, Ueber die, von Dr. O. Schlüter, 777 †
German Antarctic Expedition at, 641
Iles Kerguelen: Centre scientifique de l'expédition allemande, 237 †
Kerremans, M., journey in the basin of the Upper Sanga, 755
Key Islands—
Key oder Kii-Inseln des O. I. Archipelago, aus dem Tagebuche eines Colonisten, von Kapt. H. G. Langen, 525 †
Keyes, C. R., Composite Genesis of the Arkansas Valley, 235 †
Kharga Oasis: its Topography and Geology, by John Ball, 527 †
Khunza, Himalayas, 470
Kiau-chou—
Entwicklung des Kiautschou-Gebietes, von Maercker, 652 †
Tsingtau und Kiautschou, 768 †
Kibero Springs, Unyoro, Analyses of Samples of Water and Salt from, 50
Kiepert, Dr. R., Formæ Orbis Antiqui, 537 †; Karte von Kleinasien, 245 †, 411 †, 786 †
Kikamba Language, Vocabulary of the, by S. Watt, 655 †
Kikuyu, country of, Uganda Protectorate, 2
Kilimanjaro, Mount, Dr. Carl Uhlig's ascent of, 755
Kimball, H. H., Ice Caves and Frozen Wells as Meteorological Phenomena, 407 †; note on, 220; the General Circulation of the Atmosphere, 780 †
Kimolos, L'Ile de, par H. Hauttecœur, 650 †
King, W. J. H., Photographs of the Algerian Sahara, 538 †
King Charles' Land—
Bidrag till Kung Karls lands geologi, af A. G. Nathorst, 110 †
König Karl Land and North-East Greenland, Geology of, Prof. Nathorst's observations, 510
King George Island, South Shetlands, 761
Kingsley, Mary, by Mrs. J. R. Green, 409 †; From an African Standpoint, by Rev. M. C. Hayford, 534 †
Kinsha river of West China, letter from W. R. Carles on, 518
Kirando, Lake Tanganyika, 599
Kirchhoff, Dr. A., und Dr. K. Hassert, Bericht über die neuere Litteratur zur deutschen Landeskunde, 766 †
Kishm, Persian gulf, 127
Kivu—
Kivu-Vulkane, Die, von Hauptmann Herrmann, 526 †; note on, 217
Knapp: *see* Huntingdon
Knett, J., Ueber die Beziehungen zwischen Erdbeben und Detonationen, 661 †
Knipping, E., Sturmtabellen für den Atlantischen Ozean, 111 †
Knowles, W. J., Report on the Historic Remains from the Sandhills of the Coast of Ireland, 523 †
Knudsen, M., L'Océanographie des détroits danois, 649 †
Kobdo, lakes and river, 578
Koch, R., Ein Versuch zur Immunisirung von Rindern gegen Tsetsekrankheit, 398 †
Koettlitz, Dr. R., Polar Work: What it is, etc., 238 †
Kohlschütter, Dr. E., Die kartographischen und geophysischen Arbeiten der Pendel-Expedition . . . in Deutsch-Ost-Afrika, 656 †; note on, 639; Die Grabenländer im Nördlichen Deutsch-Ost-Afrika, 528 †
Kola Peninsula—
Geologische Entwicklung der Halbinsel Kola in der Quartärzeit, von W. Ramsey, 767 †
Kolbe, Prof. H. J., Ueber die Entstehung der zoo-geographischen Regionen auf dem Kontinent Afrika, 654 †

Kolumadulu atoll, Maldives, 283
Kongo: *see* Congo
Koppename Expedition in Dutch Guiana, 758
Kopsch, H., Britain's Trade with China, 105 †
Kòsćak, Dr. J., La Bosnie et l'Herzegovine, 391 †
Koslows, P. K., Nachrichten von der Expedition von, von General Krahmer, 768 †
Kósova tribe, Uganda Protectorate, 4
Koweit—
  Affaire de Koueït, par H. de Peyerimhoff, 231 †
Kozloff, Captain P. K., The Russian Tibet Expedition, 1899–1901..576*; expedition in Central Asia, 85
Krafft, H., A travers le Turkestan Russe, 654 †; review of, by W. R. Rickmers, 743
Krahmer, General, Nachrichten von der Expedition P. K. Koslows, 768 †
Krassnow, Prof. A., Die Stellung von Kolchis in den feuchten subtropischen Gebieten der Erde, 397 †; Die Flora der südrussischen Steppen, 395 †
Krauske, Marie, Breslaus Stellung im Schnellverkehr, 227 †
Krauss, P., Radfahrer-Uebersichtskarte von Deutschland und den benachbarten Ländern, 113 †, 535 †
Kretschmer, Dr. K., Die Beziehungen zwischen Geographie und Geschichte, 410 †
Kronstadt to Vladivostok and return, Instructions for Sailing from, 765 †
Kropotkin, Prince, on Altitudes in Asiatic Russia, 634
Krug, Martha, Die Kartographie der Meeresströmungen, 532 †
Kruse, Dr., Botanical Expedition to East Greenland, 378
Kuango river, Ubangi basin, 89; Voyage d'exploration dans l'intérieur du, par M. Séguin, 233
Kuan-Go-Chen, Kan-su province, 594
Kuganguak valley, Disco island, 379
Kuh-i-Hezár, Persia, 167
Kuh-i-Khoja, Persia, 144
Kurdistan, Central, by Major F. R. Maunsell, 106 †
Kurdistan, Dans le, par P. Galland, 770 †
Kuskokwim river, Alaska, 610
Kwang-tung province, 734

L.

Labrador—
  Geology of the North-East Coast of, by R. A. Daly, 774 †
  Life in, by W. T. Grenfell, 529 †
Laccadives—
  Fauna and Geography of the Maldive and Laccadive Archipelagoes, by J. S. Gardiner, 396 †
  Formation of the, 277
Lacger, M. l'abbé L. de, La plaine hongroise: Alföld et Puszta, 522 †
Lachen and Lachung valleys, 464, 474
Lacy, G., A Century of Exploration in South Africa, 772 †
Ládia, Persia, 139
Ladoga—
  Lac de Ladoga au point de vue thermique, par Lieut.-Colonel J. de Schokalsky, 394 †
Ladyghin, M., explorations in Tibet, 577, 578
Lahache, M. J., L'eau dans le Sahara, 233 †
Lake District, Highways and Byways in the, by A. G. Bradley, 104 †
Lakes, recent papers on, 380
Lallemand, Ch., Le Nivellement Général de la France, 393 †; La Réfection du Cadastre, et la carte de France, 393 †
Lamington, Lord, remarks on the "Artesian Water-supply of Australia," 570
Lammens, H., Le chemin de fer de La Mecque et les musulmans indiens, 770 †
Lamu, Count Wickenburg's journey from Jibuti to, 216
Land-areas—
  Problem früheren Landzusammenhangs auf der südlichen Erdhälfte, von Dr. H. Simroth, 780 †
"Landes" of Gascony, Dr. Engell on the, 750
Landesen, W. v., Reiseskizzen aus Transkaukasien, 231 †
Langhans, P., Politisch-militärische Karte von Afghanistan, Persia und Vorder-Indien, 114 †; Spezialkarte von Marungu und Utembue, 536 †; Die Wassererwerbs-Bevölkerung im Deutschen Reiche, 393 †; Reisewege des Presbyterianer-Missionars Alexander Ross von Alt-Kalaber ins Kamerun Gebiet, 786 †
Langler, Mr., remarks on the "Artesian Water-supply of Australia," 573
Langley, S. P., Diary of a Voyage from San Francisco to Tahiti and Return, 531 †
Laos—
  Le Laos, par L. de Reinach, 524 †
  Tribus Khas du Bas-Laos, 230 †
La Plata—
  Ecuador, Island of, Archæological Investigations on the, by G. A. Dorsey, 402 †
  Estuary, Tides and Sandbanks in the, J. Figueroa's observations on the, 93
  Régimen del Rio de la Plata y su corrección, por A. Foster, 658 †
Lapparent, A. de, La Question des Pénéplaines envisagée à la lumière des faits géologiques, 407 †; Le Problème Alpin, 765 †
Lateritfrage, Zur, von Dr. O. Lenz, 406 †
Latitude Variation—
  Veränderlichkeit der geographischen Breiten, von Dr. T. Albrecht, 406 †

Latitudes and Longitudes—
Accessions to Collection of, 780 †
Lavagne, P., Répartition de la population en Angleterre au cours du XIX^e^ siècle, 395 †
Leclercq, J., Le conflit entre la Russie et la Finlande, 229 †; letter from, on the Belgian Antarctic Expedition, 519; Voyage d'une Française dans l'Indo-Chine, 525 †
Le Conte, Joseph, in the Sierra, by Frank Soulé, 662 †
Lee, Sidney, Dictionary of National Biography, 240 †
Leeds, Bradford and York District, Cyclists' Road Map of the, by J. Bartholomew, 785 †
Leeward Islands, Reforestation and Rainfall in the, by W. H. Alexander, 110 †
Lei-ho coal-field, 726
Lei-ho tributary of the Siang kiang, 718
Lemaire, Captain C., The Congo-Zambezi Water-parting, 173 *; Grottes et Troglodytes du Ka-Tanga, 655 †; Mission Scientifique du Ka-Tanga, 526 †, 527 †
Lemene—
Piena del fiume Lemene in relazione alla funzione moderatrice dell' Estuario, del G. L. Bertolini, 522 †
Lenfant, Capitaine, La navigation du Niger, 400 †; La montée du Niger, 400 †
Lenz, Dr. O., Fortschritte der geographischen Forschungen und Reisen im Jahre 1900. Afrika, 242 †; Zur Lateritfrage, 406 †
Léotard, J., Le Capitaine Cazemajou, 241 †
Le Roux, H. M., Explorations in Southern Abyssinia, 87; Ménélik et Nous, 654 †; Voyage au Oullaga. Itinéraire d'Addis-Ababa au Nil Bleu, 397 †
Le Souëf, W. H., Notes of a Visit to Western Australia, 659 †
Levelling—
Ajuste de los Instrumentos de nivelar, por F. Blume, 532 †
Lewis, Rev. Thomas, The Ancient Kingdom of Kongo: its Present Position and Possibilities, 541*; Itineraries in Portuguese Congo, 526 †
Lhasa—
Première photographie de Lhassa, par J. Deniker, 397 †
Lhonak, Himalayas, 455, 458, 467
Liao-Tung—
Liao-Toung, La presqu' île de, par H. Bleton, 229 †
Liberia—
Question de Libéria, par J. H. Franklin, 400 †
Li-kiang, Yun-nan, 264; peaks north of, 268
Limestone Regions: *see* River capture
Limnology—
Einige Kapital aus der Modernen Seenforschung, von Dr. Halbfass, 532 †
Limnology—*continued.*
Revue de Limnologie, par C. Rabot, 407 †
Seenforschung, Systematische internationale, von Dr. W. Halbfass, 407 †
Wissenschaftliche . . . limnologischer Landesanstalten, von Dr. W. Halbfass, 780 †
Lindman, C. A. M., Beiträge zur Palmen-Flora Südamerikas, 530 †
Little, Mrs. Archibald, The Land of the Blue Gown, 768 †
Liverpool—
Maps: Plan of, by J. Bartholomew, 114 †
Liverpool Bay, Chart of, surveyed by H. Belam and H. G. Ashton, 244 †
Livingstone Gold Medal of the Royal Scottish Geographical Society, 381
Livingstonia Mission of the United Free Church of Scotland, Report, 526 †
Loangwa river, Rhodesia, 604
Lobai river, French Congo, 639
Lochmann, Colonel J. J., La nouvelle carte murale de la Suisse pour les écoles, 104 †
Lofty, Mount, South Australia, Memorial to Captain Flinders on, 759
London—
Greater, The Geography of, by A. M. Davies, 767 †
Ordnance Survey Plan of, Revision of the, 83
Philip's practical "Index" Guide to, by W. O. Aves, 229 †
School Board, Conference on the Teaching of Geography, 81
Longitude—
Accessions to Collection of Latitudes and Longitudes, 780 †
Appareil pour mesurer les différences de longitude à l'aide de la photographie, par M. G. Lippmann, 780 †
By Equal Altitudes, by H. B. Goodwin, 660 †
By Equal Altitudes near Noon at Sea, by W. Hall, 660 †
Lorraine, Un coin de, par A. Merchier, 393 †
Loue, Origines de la source de la, par M. A. Berthelot, 227 †
Lovisato, Prof., measurements for highest point of Sardinia, 751
Lualaba river, Central Africa, 188
Luau river, Upper Kasai, 505
Lugard, Sir F. D., Medal awarded to, 629, 647
Lugeon, Prof., Recherches sur l'origine des vallées des Alpes occidentales, 648 †; note on, 210
Luksch, Prof. J., Das Seeboden-Relief des Adriatischen Meeres, 103 †
Lukuleshi river, 183
Lulua river, Congo-Zambezi divide, 182
Lunet de Lajonquière, Capitaine E., Atlas Archéologique de l'Indo-Chine, 412 †
Lung-an, China, 254
Luschan, Dr. F. von, Ueber die alten

Handelsbeziehungen von Benin, 400 †; Vorschläge zur geographischen Nomenklatur der Südsee, 404 †
Lyburn, E. St. John, Prospecting for Gold in co. Wicklow, etc., 523 †

M.

Macao, par L. Jacqmin, 396 †; L'extension de, par R. C., 768 †
Macedonia—
Journey in, by A. A. Bashmakov, 104 †
Macédoine et ses habitants, par Testis, 229 †
McEwan, J., The Geographical Distribution of the Tea-Plant, 408 †
McGee, W J, Ice Caves and Frozen Wells, 532 †
Macgregor, Sir W., Malaria and its Prevention, 112 †
Mackenzie, G. S., remarks on the "Ancient Kingdom of Kongo," 558, 559
Mackinder, H. J., Britain and the British Seas, 523 †; review by Dr. H. R. Mill, 489
McKinley, Mount, Alaska, 610
McKinney, H. G., Intercolonial Water Rights as affected by Federation, 403 †; note on, 760
McKinnon, Ch., Journey from Domira Bay, Lake Nyasa, to Fife, on the Tanganyika Plateau, 603 *
Maclear, Vice-Admiral, Arctic Pilot, 779 †
Macmillan's Guides: Italy, Eastern and Western Mediterranean, and Palestine and Egypt, 228 †, 394 †, 410 †; review of, 366
Macoun, J., Catalogue of Canadian Birds, 529 †
Macquarie island, the *Discovery's* visit to, 442
Madagascar—
Arab Immigration into South-East Madagascar, by Rev. G. A. Shaw, 772 †
Capital of, 374
Développement de, par G. Gallieni, 637 †
Histoire de la découverte, de, par A. Grandidier, 772 †
Histoire de l'occupation du territoire des Antaimorona, par C. Huet, 657 †
Histoire physique, naturelle et politique, par A. Grandidier, 657 †
Or à Madagascar, par J. Servigny, 657 †
Pays Antanosy, Le, par Lieut. Sainjon, 657 †
Ressources minières de, par P. Hérault, 657 †
Southern, M. G. Grandidier's journey in, 90
Madeira—
Land of the Wine, being an account of the Madeira Islands, by A. J. Drexel Biddle, 107 †
Madeira—*continued*.
London to, The Voyage Southward of the *Discovery*, by Dr. H. R. Mill, 417 *
Madeira and the Canary Islands, with the Azores, by A. Samler Brown, 107 †
Madeira e o seu clima, pelo Dr. J. A. Martins, 657 †
Madrid Geographical Society—
Repertorio de Publicaciones y Tareas de la Sociedad Geográfica de Madrid, por R. B. y Rózpide, 534 †
Madrolle, C., Les premiers voyages français à la Chine, 652 †
Maenss, Prof. J., Bewegung des Elbwasserstandes bei Magdeburg, 522 †
Maercker, Herr, Die Entwicklung des Kiautschou-Gebietes, 652 †
Magellan—
Landschaftsformen der Magellan-Länder, etc., von Dr. O. Nordenskjöld, 403 †
Straits of, 313
Magila in Picture. A series of Illustrations of the Places and People in the Usambara District, 399 †
Magnetic Pole, North, A proposed Expedition to the, by Captain R. Amundsen, 97, 484 *
Magnetism: *see* Terrestrial Magnetism
Magnitnaia Mount—
Mont Magnitnaia et ses alentours, par J. Morozewicz, 394 †
Maguire, H. R., Panoramas of Nature . . . in Southern Queensland, 237 †
Mahlinga tribe, Mashonaland, 637
Mahlos atoll, Maldives, 292
Maillet, M., Résumé des Observations Centralisées par le Service Hydrométrique du Bassin de la Seine, 392 †
Makalanga tribe, Mashonaland, 637
Makrán, origin of the word, 125, *note*
Malabar, Nāyars of, Madras Government Museum, by F. Fawcett, 396 †
Malaria—
Apparition simultanée des moustiques du genre *Anopheles* et des premiers cas de paludisme dans la région de Constantine, de M. A. Billet, 410 †
Investigations in Bengal, by Messrs. Stephens and Christophers, 753
Malaria and its Prevention, by Sir W. Macgregor, 112 †
Mosquitos and, by Major R. Ross, 662 †
Paludisme, Le, sa prophylaxie, par Dr. Le Dantec, 112 †
Paludismo senza malaria, del B. Grassi, 242 †
Malay Archipelago—
Aus Insulinde. Malayische Reisebriefe, von E. Haeckel, 654 †
Smaragdinseln der Südsee, von Dr. A. Pflüger, 525 †
Maldive Islands—
Botany of the, by J. C. Willis and J. S. Gardiner, 653 †
Expedition to the, Prof. Agassiz', 480 *

Maldive Islands—*continued.*
Fauna and Geography of the Maldive and Laccadive Archipelagoes, by J. S. Gardiner, 396 †
Formation of the, by J. Stanley Gardiner, 277 *
Male, North and South, Maldives, 482
Malotet, A., De la Scarpe à l'Escaut: L'Ostrevant, 227 †
Mambere branch of the Sanga, 756
Mammoth Expedition, M. Hertz's, 215
Man—
Earliest Traces of, by Sir H. H. Howorth, 239 †
Einwirkung des Menschen auf die Natur, von F. Tamborini, 240 †
Living Races of Mankind, by H. N. Hutchinson and others, 533 †
Manager, E., La Politique Coloniale. L'invasion sicilienne en Tunisie, 108 †
Managua, Lake, Nicaragua, 320
Mancel: *see* Coonley
Manchuria—
Map of, by S. C. Borodovsky, 115 †
Wert der Mandschurei für Russland, von W. Stavenhagen, 524 †
Manika, Ancient Gem-workings in, Mr. A. V. Williams' visits to the, 372
Manuján, Baluchistan, 130
Manuscrit géographique du XVIII^e^ siècle, par L. Quarré-Reybourbon, 533 †
Manwaing, 272
Manyema telegraph line, 89
Maori Origins, by E. Best, 777 †
Map Projections—
Sketch of the Subject of, by Major C. F. Close, 238 †; review, 78
Maps—
Anwendung der Kartographischen Darstellungsmittel auf wirtschaftsgeographischen Karten, von E. Friedrich, 534 †
Geography Teaching, The Use of Maps in, by A. W. Andrews, 241 †
Lecture to Teachers on the Use of, by Mr. A. W. Andrews, 383
Philosophy of Map-making, by J. G. Bartholomew, 660 †
Maps, New—
Africa, 115, 245, 536, 664, 786
America, 115, 246, 537, 787
Asia, 114, 245, 664, 785
Australasia, Pacific Islands, 537, 665
Charts, 117, 538, 666, 787
Europe, 113, 243, 410, 535, 663, 784
General, 116, 247, 537, 665, 787
Marans, La Ville et le Comté de, par MM. Debureau, Etenaud, etc., 227 †
Marchand Expedition across Africa, Lieut. A. H. Dyé on the positions fixed by the, 505
Marcus, W., Oasen und Inseln, 239 †; note on, 223
Marcuse, Dr. J., Das Briquetagegebiet von Vic, Deutsch-Lothringen, 393 †
Marine Organisms, Some Notes on the Bipolar Theory of the Distribution of, by Edith M. Pratt, 661 †
Marinelli, O., Lo studio delle sesse nei laghi italiani, 522 †
Marinelli, S., L'Accroissement du Delta du Po au XIX^ème^ Siècle, 522 †
Markham, Sir Clements—
The *Discovery* and the Relief Ship, 435 *
Remarks on: Deaths of Lord Fitzwilliam and the Marquis of Dufferin, 520; "A Fourth Journey in Persia," 169, 173; "A Journey from Omdurman to Mombasa," 688, 690; "Glaciers of Kanchenjunga," 472, 475; Dr. Nordenskiöld's Antarctic Expedition, 764; progress of the *Discovery*, and the death of Mr. E. J. Eyre, 102; the Society's awards, 647; "The Uganda Protectorate," etc., 39, 42
Marloth, Dr. R., Notes on the Occurrence of Alpine Types in the Vegetation of the Higher Peaks of the South-Western Region of the Cape, 107 †; note on, 637
Marsabit range, Somaliland, 216
Marsden, Maurice, photographs of Alaska and Herschel Island, 788 †
Marshall, W. B., Useful Products of the Century Plant, 774 †
Marson, Prof. L., Sui ghiacciai del Bernina, 523 †
Martelli, Dr. A., Paxos e Antipaxos nel mare Jonio, 522 †
Martens, Prof. E. v., Ueber die Abgrenzung Zoogeographischer Reiche, 781 †
Martin, Dr. K., Der Regen in Südchile, 109 †
Martinique, Volcanic Eruption in, 758
Martins, Dr. J. A., A Madeira e o seu clima, 657 †
Marungu und Utembue, Spezialkarte von, von F. Langhans, 536 †
Marungu, Kupfer und Eisen in, von Dr. P. Langhans, 771 †
Maryland and its Natural Resources (Geological Survey), 109 †
Masai, The last of the, by Sidney L. and Hildegarde Hinde, review of, 200; Masai of the Naivasha district, 5, 6
Mashonaland—
Ndanga District of, Mr. Hyatt's account of, 635
Terrace slopes in, 497
Mason, Prof. O. T., Environment in Relation to Sex in Human Culture, 782 †
Matadi, Congo, 550
Matanuska river, Alaska, 610
Mathews, R. H., Ethnological Notes on the Aboriginal Tribes of the Northern Territory, 238 †
Mathuisieulx, M. de, Explorations in Tripoli, 88
Matthews, D., Native Tribes of the Upper Murray, 776 †
Maunoir, Charles (Biography), 662 †; obituary of, 513

Maurice, R. T., explorations in South Australia, 760
Maurtua, Dr. V., The Question of the Pacific, 776 †
Maxwell, Sir H., The Sad Plight of British Forestry, 104 †
Mazama, Mount, The Wreck of, by J. S. Diller, 774 †
Mazelle, E., Die tägliche periodische Schwankung des Erdbodens . . . zu Triest, 391 †
Mbrizi falls and river, Congo, 551
Meakin, Budgett, The Land of the Moors, 107 †; review of, 198
Means, T. H., On the Reason for the Retention of Salts near the Surface of Soils, 661 †
Mecca—
  Chemin de fer de La Mecque et les musulmansindiens, par H. Lammens, 770†
Medals and other Awards of the R.G.S., 629, 647
Mediterranean—
  Eastern and Western Mediterranean, Guide to the (Macmillan & Co.), 394 †; review, 366
  Grenze der Sichtbarkeit des Landes auf dem Meere, von Dr. L. Henkel, 650 †; note on, 502; map, 244 †
  Mediterranean Race, The, by Prof. G. Sergi, review of, 365
  Monthly Pilot Charts of the North Atlantic and the Mediterranean (Met. Office, London), 119 †, 248 †, 416 †, 538 †, 667 †, 787 †
Mees, J., Histoire de la découverte des iles Açores, 655 †
Meetings of the R.G.S., Session 1901–1902..101, 102, 226, 390, 520, 521, 647, 764
Meiklejohn, Prof., obituary of, 645
Meinardus: *see* Hellman
Meister, M., Russland in Asien. Historisch-wirtschaftliche Skizze, 525 †
Meitzen, Dr. A., Die verschiedene Weise des Uebergangs vom Nomadenleben zur festen Siedelung bei Kelten, Germanen und Slaven, 408 †
Mekong, upper, plateau of the, 589
Melander, G., L'influence du Vésuve sur l'air des environs, 650 †
Memel-, Pregel- und Weichselstrom, von Dr. J. Partsch, 394 †
Mendelssohn, G. B., und seine Schilderung des Riesengebirges, von P. Kämmerling, 241 †
Mendes, C., and T. Sampaio, Lingua Indigena—O nome Ceará, 236 †
Ménélik et Nous, par H. Le Roux, 654 †
Merchier, A., Un coin de Lorraine, 393 †
Meru, Mount, Dr. Carl Uhlig's ascent of, 755
Messina, Tre escursioni in provincia di, del Prof. G. Ricchieri, 650 †
Meteorology—
  Meteorology on the British Antarctic Expedition, 239 †
Metric System—
  Adoption of the Metric System of Units in all Scientific Geographical Work, On the, by Dr. H. R. Mill, 410 †
Meyer, Dr. Hans, Heutige und einstige Vergletscherung im tropischen Ost-Afrika, 399 †
Mexico—
  Century Plant of, Useful Products of the, by W. B. Marshall, 774 †
  Earthquake in the State of Colima, Remarks on the, by C. W. Haines, 234 †
  Excursion à travers le Mexique, par M. Louis George, 401 †
  Geografia en Mexico, Los progresos de la, por Prof. E. Noriega, 529 †
  Iluminacion y Avalizamiento en las Costas de los Estados Unidos Mexicanos, 774 †
  Lord Lamington's Travels in, An Account of, by J. P. Thomson, 234 †
  Mexican Colonies from the Canary Islands traced by Language, by Rev. J. Campbell, 529 †
  Mexico as I saw it, by Mrs. Alec Tweedie, 234 †
  New Mexico, The, by J. W. Foster, 774 †
  Nord-ouest du Mexique, par H. Buttgenbach, 774 †
  Territoral . . . der Mexikanischen Republik, von Dr. E. Deckert, 774 †
Mián Kangi, Persia, 147
Middendorf fjord, Taimyr peninsula, 478
Mil-i-Nádiri, Persia, 159
Mill, Dr. H. R.—
  and H. S. Wallis, On the Distribution of Rain over the British Isles during 1900..229 †
  Meteorology on the British Antarctic Expedition, 239 †
  Oceanographical Research in the Atlantic, 354 *
  On the Adoption of the Metric System of Units in all Scientific Geographical Work, 410 †
  On the Introduction of a Systematic International Terminology and Nomenclature for the forms of Sub-Oceanic Relief, 407 †
  Remarks at the Geographical Association Meeting, 382; on the "Artesian Water-supply of Australia," 572
  Review of Mackinder's Britain and the British Seas, 489
  The Voyage Southward of the *Discovery*. I. London to Madeira, 417 *
Miller, A. M., Preglacial Drainage in South-Western Ohio, 235 †
Miller, W. R., Hausa Notes, 657 †
Mináb, Baluchistan, 129
Minikoi atoll, Laccadives, 277, 279; Note on the Flora of, by J. C. Willis, 653 †
Minutilli, F., La Tripolitania, 400 †
Mirage—
  Observations de mirage, Note sur des, par M. Hervé, 780 †

Mishmi Country, Military Report on the, by Lieut. G. L. S. Ward, 653 †
Mississippi—
Flood-level of the, Major Derby on the changes in the, 508
Maps of the, by W. Davis, 775 †
Missouri River, Bluffs of the, by Miss L. A. Owen, 402 †
Mitylene—
Ile de Mételin, par B. Girard, 523 †
Moab and Edom, Recent Investigations in, by Sir C. W. Wilson, 770 †
Moape, Congo basin, 175
Mobsby, —, Steam Traffic and Trade on the Upper Yangtse, 230 †
Mochi, Dott. A., Di Luigi Maria D'Albertis e della sua opera scientifica, 409 †
Moekler-Ferryman, Lieut.-Col., British Nigeria, 772 ‡
Mohn, Prof. Dr. H., Ergebnisse der meteorologischen Beobachtungen der Norwegischen Polar-Expedition mit der "Fram," 405 †
Mohun, Mr., expedition for the Congo State Telegraphs, 89
Moïse, Les sources de, par A. A. Boddy, 772 †
Moisel, M., Begleitworte zu der Karte "Die Flussgebiete des Mungo und Unteren Wuri," 657 †; Dr. F. Stuhlmann's Aufnahmen im Gebiet des Albert- und Albert-Edward-Sees, 536 †, 771 †
Molesworth, Sir G., The Uganda Railway, 658 †
Mombasa, A Journey from Omdurman to, *viâ* Lake Rudolf, by Major Austin, 669 *
Monckman, J., The Glacial Geology of Bradford, 105 †
Monckton, H. W., On the Origin of the Gravel-Flats of Surrey and Berkshire, 229 †
Mongolia—
Voyage en Mongolie, par M. le Baron de Batz, 396 †
Monnier, M., Itinéraires à travers l'Asie, 651 †
Montell, A., Le Chemin de fer du Dahomey, 527 †
Montenegro—
Escursione archeologica del dott. R. Paribeni nel Montenegro, del A. Baldacci, 391 †
Gletscherspuren in Montenegro, von Prof. Dr. Kurt Hassert, 650 †
Reise durch, im Sommer 1900, von K. Hassert, 228 †
Monte Rosa—
Stato attuale dei ghiacciai del Monte Rosa, del G. Dainelli, 522 †
Montet, Dr. E., A Special Mission to Morocco, 772
Moore, A. W., The Alps in 1864, edited by A. W. B. Kennedy, 765 †
Moore, Harrison, The Constitution of the Commonwealth of Australia, 659 †
Moore, J. E. S., remarks on "The Uganda Protectorate, etc.," 40
Moore, Prof. J. B., Boundaries of the United States, 401 †
Moraines—
Geschichte der Moränenkunde, von Dr. A. Böhm, 532 †
Moran, Cardinal, Was Australia discovered by De Quiros in the year 1606? 530 †; note on, 377
Morel, E. P., The Congo State and the Bahr-el-Ghazal, 232 †
Moreno, F., Perú. Las Irrigaciones de la Costa, 403 †
Morgan A., Advanced Physiography, 239 †
Morocco—
Journey to Morocco City, by Captain P. H. Fawcett, 189 *
Land of the Moors, by Budgett Meakin, 107 †; review of, 198
Marokko, von Dr. K. Floericke, 657 †; Ditto, von W. Jaap, 657 †
Mission d'études au Maroc, par E. Doutté, 657 †; note on, 375
Notes on, by Isabella L. Bishop, 107 †
Photographs of, by Captain P. H. Fawcett, 540 †
Special Mission to, by Dr. E. Montet, 772 †
Surveys in, by Dr. Weisgerber, 88
Voyage au Maroc de Georges Forret, Note sur le, par R. de F. Roquevaire, 657 †
Wirthschafts-geographie von Marokko, Vier Karten und Studien zur, von Dr. R. Arnold, 107 †
Morozewicz, J., Le Mont Magnitnaia et ses alentours, 394 †
Morris, Prof. E. E., On the Tracks of Captain Cook, 777 †
Mortensen, Dr. T., Fra den danske videnskabelige Siam Expedition, 397 †
Morton: *see* Brodrick
Moskauer Industriegebiet und der Oberlauf der Wolga, von S. Tschulok, 650 †
Mosquitoes—
Monograph of the Culicidæ, or Mosquitoes, by F. V. Theobald, 781 †
Mother-of-Pearl Oysters, On the Identity and Distribution of the, by H. L. Jameson, 112 †
Mountains—
Mountains, by Prof. James Geikie, 111 †, 780 †
Precipitation on Mountain Slopes, Prof. E. Pockels on the formation of, 192
Schrumpfungstheorie im Lichte der Kritik, von P. J. Müller, 111 †
Mourey, C., et L. Brunel, L'Année Coloniale, 242 †
Mozambique—
Diccionario Chorographico da Provincia de Moçambique por Gomes da Costa, 108 †
Mpala, Lake Tanganyika, 599
Mubuko valley, Ruwenzori, 29: glacier of, 36

Muff: *see* Kendall
Müller, C., Claudii Ptolemæi Geographia, 408 †; Die Kunde des Altertums von den Canarischen Inseln, 106 †
Müller, P. J., Die Schrumpfungstheorie im Lichte der Kritik, 111 †
Muñoz, J. L., La Cuestión de Límites con el Brasil, 659 †
Muret: *see* Finsterwalder, 407 †
Murray, George, The Voyage Southward of the *Discovery*. II. From Madeira to the Cape, 423 *
Murray, Sir John (Biography of), von W. Wolkenhauer, 662 †; remarks on "The Formation of the Maldives," 297; Survey of British Lakes, 369; Deep-Sea Deposits and their Distribution in the Pacific Ocean, 691 *; On the Results of a Deep-sea Sounding Expedition in the North Atlantic, by R. E. Peake, with Notes on the Temperature Observation, etc., by, 781 †
Murray, Upper, Native Tribes of the, by D. Matthews, 776 †
Murray, W. R., explorations in South Australia, 760
Museums—
  Reports and Returns (Museums, etc.), Instructions and Minutes, 112 †
Mushketoff, Prof., obituary of, 514
Mwemwashi river, 188
Myothet, Burma, 272

N.

Naita, Mount, East Central Africa, 676
Naivasha, Lake, Uganda Protectorate, 2, 8
Nakchang-tso, Lake, Tibet, 502
Nak-chu, Mekong tributary, 587
Nan, Trade of (Foreign Office Rep.), 106 †
Nandi plateau, Uganda Protectorate, 10
Nanling range, China, 732
Narym region, M. A. T. Plotnikoff's work on the, 635
Nasratabád, Persia, 143
Nassau, R. H., Fetishism, a Government, 400 †
Natal—
  Geological Survey of Natal and Zululand, First Report of the, by W. Anderson, 772 †
  Mining Industry of, Report on, by G. J. Gray, 107 †
Nathorst, A. G., Bidrag till Kung Karls lands geologi, 110 †; A. E. Nordenskiöld (Biography of), 241 †; on the geology of König Karl Land and North-East Greenland, 510; Två Somarar i Norra Ishafvet, review of, 80
Natterer, Dr. K., Ueber chemisch-geologische Arbeiten der "Pola" Expeditionen, 407 †
Nautical Almanac and Astronomical Ephemeris for 1905. .780 †
Navarra, B., China und die Chinesen, 524 †
Ndanga District of Mashonaland, Mr. S. P. Hyatt's account of, 635
Ndembu river, Upper Kasai, 505
Neal, W. G., and R. N. Hall, The Ancient Ruins of Rhodesia, 772 †
Neckar Canal, report on the, 210
Negreiros, A. d'Almada (Biography of), 534 †; Colonies Portugaises: Angola, 526 †; Colonies Portugaises. Ile de San-Thomé, 658 †; La Main-d'Œuvre en Afrique, 398 †
Negri Sembilan, State of, Annual Report on the, by D. G. Campbell, 105 †
Neh, Persia, 156
Nehring, Dr. A., Ein fossiles Kamel aus Südrussland, 238 †; Ueber die heutige Fauna der russischen und westsibirischen Steppen, 394 †
Neovius, E. R., La densité de la population en Finlande, 766 †
Neumayer, Prof. Dr. G. von, Auf zum Südpol! 238 †; review of, 362; Zweiter Thätigkeitsbericht der Deutschen Kommission für die Südpolar-Forschung, 660 †; Die Ergebnisse neuerer erdmagnetischer Beobachtungen in den Polar-Regionen, 779 †
Neuweiler, E., Beiträge zur Kenntnis schweizerischer Torfmoore, 229 †
Neve, Dr. E. F., The Pir Punjal Range and Tatticooti, Kashmir, 653 †
Newbigin, Marion, Sir John Murray's Scheme for the Investigation of the Natural History of the Forth Valley, 651 †
Newby, J. R., Iceland and the Icelanders, 228 †
New Caledonia—
  Trade of (Foreign Office Rep.), 237 †
New Forest, A Village in the, by C. Gleig, 651 †
Newfoundland—
  Découverte et Evolution Cartographique de Terre Neuve et des Pays circonvoisins, par H. Harrisse, 234 †; review of, 625
New Guinea—
  British: Notes on a Government Expedition . . . to the Main Range in, by Sir F. P. Winter, 237 †; note on, 95; Report for 1899-1900 (Colonial Rep.), 777 †
  Cambridge Anthropological Expedition to Torres Straits, Reports of the, 238 †
  French Expedition in, Disaster to, 761
  Zuidkust van Nieuw-Guinea, door J. F. Niermeyer, 531 †
New South Wales—
  Exploration in 1844, Letters from E. J. Eyre, 777 †
  Intercolonial Water Rights in, 760
  Iron Ore Deposits of, by J. B. Jaquet, 237 †; note on, 94
  Mines, Department of, Annual Report of the, 777 †
  Picturesque, by T. A. Coghlan, 777 †
  Sites for the Seat of Government of the Commonwealth, Report of the Commissioner on, 403 †

New York—
Maps: Stevens's Facsimile of the Unpublished British Head Quarters Coloured Manuscript Map of, 414 †
New Zealand—
Artesian Well system at the base of the Port Hills, by S. Page, 777 †
Lands and Survey, Report of the Department of, by A. Barron, 531 †; note on, 221
Map of (Department of Lands and Survey), 414 †
Official Year Book, by E. J. von Dadelszen, 777 †
On the Tracks of Captain Cook, by Prof. E. E. Morris, 777
Plant-acclimatisation in, by G. M. Thomson, 777 †
Population of, by H. W. Segar, 777 †
Te Whanga-Nui-A-Tara, by E. Best, 531 †
Nicaragua—
Hydrography of, by A. P. Davis, 403 †
Lake, 320; canal route through, 327
Maps: Tiefenkarte des Nicaragua-Sees, nach den Aufnahmen der Nikaraguakanal Kommission, 537 †
Niebuhr: *see* Winckler
Niermayer, J. F., De uitbarsting van 1593: Raun of Ringgit? 654 †; De Zuidkust van Nieuw-Guinea, 531 †
Nies, Rev. J. B., Notes on a Cross Jordan Trip, 232 †
Nieuwenhuis, Dr. A. W., Mededeelingen over het vervolg der commissiereis naar Centraal-Borneo, 397 †
Niger—
Montée du Niger: Mission Lenfant, 400 †
Navigation du Niger: La flottille du Capitaine Lenfant, 400 †
Nigeria, British, by Lieut.-Colonel Mockler-Ferryman, 772 †
Nile—
Barrage du Nil au dessous d'Assouan, Note sur le grand, par Dr. A. de Claparède, 399 †
Bird Hunting on the White Nile, by H. F. Witherby, 656 †
Cataracte du Nile, De quelques particularités de la première et de la seconde, par Dr. A. de Claparède, 399 †
Découvertes géologiques récentes dans la vallée du Nil et le désert Libyen, par H. J. L. Beadnell, 655 †
Nil-Quellen, Ueber die neuesten Forschungen im Gebiet der, von A. Graf von Götzen, 398 †
Reservoir Dam at Assuân and After, by W. Willcocks, 655 †
Roman Catholic Mission on the Upper Nile, Concerning a Former, by Rev. W. A. Crabtree, 232 †
Nilgiri Mountain Railway, by W. J. Weightman, 396 †
Nimbuluk, Persia, 153
Nisbet, John, Burma under British Rule and Before, 524 †
Nishiwada, K., Kurzer Bericht über eine Reise nach Schehol in Nord-China auf dem Lan-hô, 652 †
Noki, Congo, 550
Nome, Cape—
Goldgebiet am Kap Nome, 400 †
Origin of the name of, Prof. G. Davidson on the, 92
Nordenskiöld, Baron A. E. (biography), 534 †; by W. S. Bruce, 409 †; von Moritz Lindeman, 409 †; von Prof. Dr. A. G. Nathorst, 241 †
Nordenskjöld, Dr. O., Antarctic Expedition of, 761, 764; Die Landschaftsformen der Magellan-Länder, etc., 403 †
Noriega, Prof. E., Los progresos de la Geografia en Mexico, 529 †
Norman, Sir Henry W., remarks on "From Shanghai to Bhamo," 274
Norway—
Morphologie von Norwegen. Neue Beiträge zur, von Prof. Dr. E. Richter, 228 †
Physical History of the Norwegian Fjords, by Prof. E. Hull, 394 †
Novaya Zemlya, Expedition to, under Dr. Ekstam, 221
Novosiltsof, A. N., surveys on the Lower Pechora, 369
Nubkissen Bahadur, Maharaja, Memoirs of, by N. N. Ghose, 782 †
Nyanja Language, A Practical Manual of the, by Rev. A. Hetherwick, 655 †
Nyasa, Lake—
Journey from Domira Bay to Fife on the Tanganyika Plateau, by Ch. McKinnon, 603 *
Nyasaland—
Rift-valley of, 639
Zulu of, by Rev. D. Fraser, 526 †

O.

Oases—
Oasen und Inseln. Ein Kulturgeographischer Vergleich, von W. Mareus, 239 †; note on, 223
Oberaba laguna, Bolivia, 66
Oberhummer, Dr. E., Ueber Hochgebirgs-Karten, 405 †
Ocean Bars, Methods of Improving, by L. M. Haupt, 534 †
Ocean routes—
Atlantic Ferry, The: Louisburg and Milford Haven, 239 †
Oceanography—
Atlantic, Oceanographical Research in the, by Dr. H. R. Mill, 354 *
Classification des Fonds sous-marins, etc., par Prof. J. Thoulet, 407 †
Conférence internationale pour l'étude de la mer, Stockholm, par M. J. Thoulet, 111 †
Constitution du sol subocéanique, Sur la, par J. Thoulet, 81 †

Oceanography—*continued.*
Deep-sea Sounding Expedition in the North Atlantic in 1899, On the Results of a, by R. E. Peake, with Notes on the Temperature Observations, etc., by Sir J. Murray, 781 †
Distances moyennes à la côte dans les océans, Sur les, par J. de Windt, 239 †
Expedition S. M. Schiff "Pola" in das Rothe Meer, von P. E. von Pott, 111 †
Kartographie der Meeresströmungen, von Martha Krug, 532 †
Mode de récolte des échantillons du sol sous-marin, par J. Thoulet, 533 †
Mighty Deep, and what we know of it, The, by Agnes Giberne, 239 †; review, 365
Nomenclature for the forms of Sub-Oceanic Relief, On the Introduction of a Systematic International Terminology and, by Dr. H. R. Mill, 407 †
Nomenklatur für das Bodenrelief der Oceane, Einführung einer einheitlichen, von Dr. O. Krümmel, 407 †
Oceanic Depths and Serial Temperature Observations, List of, 239 †
Plankton-organisms, Notes on Some, by P. T. Cleve, 781 †
Profondeurs de la Mer, Les plus grandes, 781 †
Résultats des Campagnes scientifiques accomplies sur son yacht par Albert Prince de Monaco, Fasc. xix. et xx., par J. Thoulet et T. Studer, 533 †
Thermomètres électriques de profondeur, par P. Gasnier, 111 †
Transparence et la couleur de la mer, par J. Thoulet, 533 †, 781 †
Transparenz und Farbe des Meerwassers, J. Luksch's Untersuchungen über die, von Prof. T. Fuchs, 781 †
Variations Annuelles de l'eau de surface de l'Océan Atlantique, par Cleve, Ekman et Pettersson, 533 †
Oder—
Bildung des linken Oderufers von Stettin bis Pölitz, von Dr. Winkelmann, 522 †
Glaciale Druck- und Faltungserscheinungen im Oder-Gebiet, von Dr. F. Frech, 649 †
Odessa—
Formation des lagunes dites "Limans" des environs d'Odessa, par G. du Tronquoy, 651 †
Ogowe—
Boucle de l'Ogôoué, Dans la, par Lieut. Avelot, 233 †
Ohio, South-Western, Preglacial Drainage in, by A. H. Miller, 235 †; ditto, by W. G. Tight, 402 †
Ohlin, A., Arctic Crustacea collected during the Swedish Arctic Expeditions, 531 †
Okhotsk, Tertiary Deposits at, 754
Oldham, R. D., on the Geological History of the Son Valley, 84, 230 †
Olivier, E., La Cartographie en 1900.. 405 †
Olmet, F. de Antón del, El problema de la China, 524 †
Olufsen, O., Den anden danske Pamir-expedition, 397 †
Oman, Northern, Three Journeys in, by Rev. S. M. Zwemer, 54 *
Omdurman to Mombasa, A Journey from, *viâ* Lake Rudolf, by Brevet-Major H. H. Austin, 669 *
Ontario—
Central, Physical Geography of, Mr. A. W. G. Wilson on, 376
Ophir—
Gold of Ophir, Whence brought and by Whom? by Prof. A. H. Keane, 409 †; review, 361, 495
Rhodesia and the Ophir Problem, 495
Ordnance Survey Maps of England and Wales, 113 †, 243 †, 410 †, 535 †, 663 †, 784 †
Ordnance Survey Plan of London, Revision of the, 83
Ordnance Survey Revised Map of the British Isles, 784 †
Orléans, Prince Henri d', Mort du, 534 †; (Biography), 782 †; par Colonel de la Panouse, 112 †
Ormára, Makrán, 129
Orok-nor, Tibet, 580
Osborne: *see* Hall
Ostrevant—
De la Scarpe à l'Escaut, L'Ostrevant, par A. Malotet, 227 †
O'Sullivan, H., Report of Progress of Exploration in the Country between Lake St. John and James Bay, 234 †; note on, 91
Ottawa and St. Lawrence Rivers, Physical Features and Geology of the Palæozoic Basin between the, by R. W. Ells, 528 †
Otuquis river, Bolivia, 72
Oubangui: *see* Ubangi
Owen, Miss L. A., The Bluffs of the Missouri River, 402 †
Oxford School of Geography, Report, 643

P.

Pacific—
Amongst Tropical Islands, by Miss H. Chewings, 531 †
Australien und Südseefahrt von Dr. A. Daiber, 776 †
Deep-Sea Deposits and their Distribution in the, by Sir John Murray, 691 *
Diary of a Voyage from San Francisco to Tahiti and Return, by S. P. Langley, 531 †
Geographischen Nomenklatur der Südsee, Vorschläge zur, von Dr. F. von Luschan, 404 †
Jesup-Nordpacifischen Expedition, von Dr. F. Boas, 408 †, 409 †

Pacific—*continued.*
Log of an Island Wanderer, by E. Pallander, 404 †
Mastery of the, by A. R. Colquhoun, 777 †
Question of the, by Dr. V. Maurtua and F. A. Pezet, 776 †
Sunshine and Surf. A Year's Wanderings in the South Seas, by D. B. Hall and Lord A. Osborne, 237 †
Page, James, The Drift of Floating Bottles in the Pacific Ocean, 111 †
Pahang, State of, Annual Report on the, by H. Clifford, 105 †
Palembang, Sumatra, 755
Palestine—
Guide to Palestine and Egypt (Macmillan & Co.), 410 †; review, 366
Zuallardo's Travels in, Colonel Conder on, 753
Pallander, E., The Log of an Island Wanderer, 404 †
Pamir—
Pamirexpedition, Den anden danske, ved O. Olufsen, 397 †
Panama—
Canal across, 326, 329; probable value of, 334–346
Canal Works, Present Condition and Prospects of the, by J. T. Ford, 110 †
Isthme de Panama et le Canal Interocéanique, par M. Bel, 776 †
Isthmus of, early history of, 319
Latest Route proposed for the Isthmian Canal, 775 †
Pando, Rio, Bolivia, 66
Panouse, Colonel de la, (Biography of) Henri d'Orléans, 112 †
Paraguay—
Exploraciones practicadas en el Alto Paraguay y en la Laguna Gaiba por Enrique Bolland, 110 †
Limites entre Bolivia y el Paraguay, La Cuestión de, por Dr. A. Quijarro, 529 †
Vanished Arcadia, A, being some account of the Jesuits in Paraguay, by R. B. C. Graham, 403 †
Paraná river, Regulation of the, 759
Parker, E. H., John Chinaman and a few others, 105 †
Parkinson, J., Notes on the Geology of South-Central Ceylon, 105 †
Parma—
Lage von Parma und ihre Bedeutung im Wechsel der Zeiten, von Dr. L. Schütte, 228 †
Parsons, Hon. J. L., and M. W. Holtze, The Northern Territory of South Australia, 404 †
Parsons, W. B., Photographs of China from Hankau to Canton, 668 †; From the Yang-tse Kiang to the China Sea, 711 *
Partsch, Dr. J., Der Ausflug . . . zu den Glacialablagerungen des Riesengebirges, 394 †; Memel-, Pregel- und Weichselstrom, 394 †; Die Geographie an der Universität Breslau, 241 †
Pasquier, H., Les chemins de fer tunisiens devant Parlement, 234 †
Passarge, Dr. S., Die Hydrographie des nördlichen Kalahari-Beckens, 400 †
Pastaza river, South America, 316
Pasteyns, Fr., Alaska, 775 †
Patagonia—
Lebermoos-Flora Westpatagoniens und des südlichen Chile, von F. Stephani, 530 †
Paul, A. W., remarks on the "Glaciers of Kangchenjunga," 473
Pauwel, M. D. de, explorations between the Sanga and the Ubangi, 639
Pawlowski, A., Carte-plan de l'île d'Aix dressée par Cornuau, 393 †; La Gironde et le Golfe de Gascogne au XVI^e^ siècle, 766 †
Paxos and Antipaxos—
Paxos e Antipaxos nel mare Jonio, del Dr. A. Martelli, 522 †
Payne, E. J., review of Beazley's Dawn of Modern Geography, 498
Peacock, J. A. W., Light Railways in Egypt, 399 †
Peake, R. E., Deep-Sea deposits collected by, 691; On the Results of a Deep-sea Sounding Expedition in the North Atlantic, with Notes, etc., by Sir John Murray, 781 †
Pearce: *see* Duparc
Pearl Oysters and Pearl Fisheries, by O. Collett, 408 †
Peary, Lieut., expeditions in 1900 and 1901..96
Pechora, Lower, M. A. N. Novosiltsof's surveys in the, 369
Pedroso, Z. C., Luciano Cordeiro, 782 †
Pelagic deposits, composition of, 693
Pelée, Mont, Martinique, eruption of, 758
Pelet, P., Atlas des Colonies Françaises, 247 †
Pelseneer, Paul, letter from, on the Belgian Antarctic Expedition, 387
Penck, Dr. A., Einige neuere Ergebnisse der Eiszeitforschung in den Alpen, 648 †; Ueber die Herstellung einer Erdkarte im Massatab 1 : 1,000,000.. 405 †; Die Uebertiefung der Alpen-Thäler, 391 †
Penck, Dr. A., und Dr. E. Brückner, Die Alpen im Eiszeitalter, 391
Penton, E., The New Trade Route to Persia by Nushki and Sistán, 525 †
Perak Administration Report for 1900, by Colonel R. S. F. Walker, 105 †
Péroz, Colonel, journey in the French Sahara, 218
Persia—
Apuntes de un viaje en Persia, por A Finn, 231 †
Description of Persia and Mesopotamia in 1340, by G. Le Strange, 769 †
Eastern: Geological Sketch of the

Persia—*continued.*
Baluchistan Desert and part of, by E. Vredenburg, 395 †; M. Zarudnyi's journey in, 752
Fourth Journey in, 1897-1901, by Major P. Molesworth Sykes, 121 *
Maps: Politisch-militärische Karte von Afghanistan, Persia, etc., von P. Langhans, 114 †
New Trade Route to Persia by Nushki and Sistán, by E. Penton, 525 †
Persia by a Persian, by Rev. I. Adams, 769 †
Photographs of, by Major P. M. Sykes, 248 †
Subjects of the Shah, by Rev. C. H. Stileman, 769 †
Voyage en Perse orientale, par N. Zarudnoï, 769 †
Persian Gulf—
History and legends of, 121-123
Trade of (Foreign Office Rep.), 525 †
Persian War, The Great, and its Preliminaries, by G. B. Grundy, 227 †; review of, 360
Perthshire, lochs of, Sir John Murray's survey of, 369
Peru—
Apuntes de Viaje del G. Sala, 403 †
Descripcion del, por T. Haënke, 403 †
Indios Uros del Peru y Bolivia, por J. T. Polo, 776 †
Interoceanic communication in, 315
Irrigaciones de la Costa, por F. Moreno, 403 †
Itinerario de los viajes de Raimondi en el Peru, 776 †
Montanas de Ayacucho, etc., por D. P. Portillo, 403 †
Question of the Pacific, by Dr. V. Maurtua and F. A. Pezet, 776 †
Revisión del arco meridiano del Perú, por P. Clément, 776 †
Travelling Impressions in, by Felix Seebee, 236 †
Pestalozza, G., Somalia Italiana, 656 †
Peters, Dr. Carl, *Ophir* and *Punt* in South Africa, 773 †
Pettersson, Prof. O., Ueber systematische hydrographisch-biologische Erforschung der Meere, Binnen-Meere, und tiefen Seen Europas, 392 †
Peucker, Dr. Karl, Prof. Cvijić on the Structure of the Balkan Peninsula, 735
Peyerimhoff, H. de, L'Affaire de Koucït, 231 †
Pflüger, Dr. A., Smaragdinseln der Südsee, 525 †
Philippi, von A. Struck, 229 †
Philippi, Dr. E., Die geologischen Probleme der Antarktis, 660 †
Philippine Islands—
Archipiélago Filipino, El. Colección de datos geográficos, etc., 397 †; review, 619
Geographic Names in the, Special Report of the United States Board on, 106 †
Maps: Progress Map of Signal Corps Telegraph Lines and Cables in the Military Division of the, by A. W. Greely, 664 †
Philippson, Prof. Dr. A., Der Gebirgsbau der Agäis und seine allgemeineren Beziehungen, 392 †; journey in Western Asia Minor, 751
Phillips, P. Lee, A List of Books, etc., relating to Brazil, 109 †; A List of Maps of America in the Library of Congress, 401 †
Photographic Exposure Record and Diary, Wellcome's, 662 †
Photographs—
Africa, British Central, by Poulett Weatherley, 119 †
Alaska and British Columbia, by W. H. Cook, 538 †
Alaska and Herschel Island, by M. Marsden, 788 †
Algerian Sahara, by W. J. H. King, 538 †
Ashanti, by M. Fergusson, 538 †
Baffinland, by Dr. R. Bell, 119 †
Bahamas, by Messrs. Coonley, Davenport, and Mancel, 539 †
Bulgaria, by N. E. Buxton, 539 †
China from Hankau to Canton, by W. B. Parsons, 668 †
Euphrates and Neighbourhood, by Messrs. Huntingdon, Knapp, and Ward, 788 †
Great Bear Lake Region, by J. Mackintosh Bell, 119 †
Hong-Kong, by H. C. Hurley, 540 †
Inambari River and Neighbourhood, 668 †
Kentucky, by Miss Semple, 120 †
Morocco, by Captain P. H. Fawcett, 540 †
Persia, by Major P. M. Sykes, 248 †
Rhodesia, Northern, by G. Grey, 120 †
Trent, "Aegir" on the, by C. L. Weller, 539 †
Physiography, Advanced, by A. Morgan, 239 †
Phyto-geography—
Ausbildung der pflanzengeographischen Kartographie, von Dr. O. Drude, 407 †
Nomenklatur in der Pflanzengeographie, Einführung einer gleichmässigen, von Dr. O. Warburg, 408 †
Pibor river, East Central Africa, 690
Pidoux, J., Mémoire sur la latitude de l'Observatoire de Genève, 104 †
Piedmont, notice sur les vallées Vaudoises du, par P. Chaix, 522 †
Ping-hsiang, coal-fields at, 726
Pio, G., Gli Italiani nel Nord dello Stato di Santa Caterina, 236 †
Pitcairn Islanders, Further Correspondence relating to the Condition of the, 531 †

Pjetursson, H., Moræner i den islandske Palagonitformation, 522 †
Place-names—
Toponomastica e Topolessigrafia, by G. Ricchieri e O. Marinelli, 663 †
Plata, Rio de la—
South Bank, Admiralty's description of, letter from G. E. C. on, 101
Pleskauer Sea—
Talabskischen Inseln auf dem Pleskauer See, von P. von Stenin, 523 †
Plotnikoff, A. T., work on the Narym region, 635
Plymouth—
Burrator Works for the Water-supply of, by E. Sandeman, 395 †
Po—
Accroissement du Delta du Po au XIX^e Siècle, par S. Marinelli, 522 †
Pockels, Prof. E., on the formation of precipitation on mountain slopes, 192
"Pola" Expeditionen, Ueber chemisch-geologische Arbeiten der, von Dr. K. Natterer, 407 †
Polar Exploration—
Polarforschung im Jahre 1901, von H. Singer, 532 †
Polar Flora—
Flora der "ewigen Schnee- und Eis-Region," von H. Holm, 405 †
Polar Regions—
Ergebnisse neuerer erdmagnetischer Beobachtungen in den Polar-Regionen, von Dr. G. Neumayer, 779 †
Polar Work: What it is, etc., by Dr. R. Kœttlitz, 238 †
Pole—
Terrestriske Nordpols Variation, af Dr. M. C. Engell, 406 †; note on, 642
Pomerania—
Pommerschen Seen, Beiträge zur Kenntnis der, von Dr. W. Halbfass, 227 †; note on, 381
Rainfall maps of Pomerania and Brandenburg, Prof. Hellman's, 501
Pomperaug valley region of Connecticut, 92
Poole, R. L., Historical Atlas of Modern Europe, 411 †
Popocatepetl—
Besteigung des Popocatepetl in Mexico im Jahre 1866, von Dr. E. R. Schmit, 529 †
Population Maps—
Bevölkerungsstatistische Grundkarten, Ueber, von Dr. A. Hattner, 409 †
Port Amelia, Expedition from, to Lake Nyassa, commanded by Major Spilsbury, 400 †
Portillo, D. P., Las Montanas de Ayacucho y los rios Apurimac, etc., 403 †
Portugal—
Mission de la Société d'océanographie en Espagne et en Portugal, par G. Desbats, 767 †
Origine des relations commerciales entre la Flandre et le Portugal, por E. Cantineau, 522 †
Positions—
Entwickelung der geographischen Ortsbestimmung, Die neuere, von Dr. A. Marcuse, 780 †
Pott, P. E. von, Expedition S. M. Schiff "Pola" in das Rothe Meer, 111 †
Pottinger, Captain, remarks on "From Shanghai to Bhamo," 276
Powell, J. W., Annual Report of the Bureau of American Ethnology, 401 †
Powell-Cotton, P. H. G., A Sporting Trip through Abyssinia, 770 †
Praeger, R. L., Irish Topographical Botany, 104 †; note on, 630
Pratt, Edith M., Some Notes on the Bipolar Theory of the Distribution of Marine Organisms, 661 †
Precession of the Equinoxes, Hipparchus and the, by Rev. M. H. Close, 532 †
Precipitation on mountain slopes, Prof. E. Pockels on, 192
Preuss, Dr. P., Expedition nach Central- und Südamerika, 236 †
Primbault, H., Promenade au Caucase et dans le Turkestan, 397 †
Privat-Deschanel, P., Le relief du Beaujolais, 649 †; Les conditions géographiques de la vie animale dans le Beaujolais, 392 †
Projections—
Projektionsbilder als Anschauungsmittel für Schulen, von Dr. H. Zimmerer, 241 †
Surface Equivalent, by C. E. Stromeyer, 406 †
Was gehört aus der Projektionslehre auf die Schule? von Dr. A. Bludau, 662 †
Prokletije peaks, Balkan Peninsula, 738
Pteropod ooze of deep-sea deposits, 694, 698, 705, 706
Ptolemy—
Claudii Ptolemæi Geographia, by C. Müller, 408 †
Publications Scientifiques de Dr. E. T. Hamy, 662 †
Puchleitner, S., Die Eiszeit in den Südkarpaten, 228 †
Puerto Cortes and the Bay of Fonseca, route between, 321, 322
Puget-Sund-Häfen, Die, 402 †
Puncaburu range, British New Guinea, 96
Pyevtsoff, General M. V., obituary of, 515
Pygmies of the Congo Forest, 24, 40

Q.

Quarré-Reybourbon, L., Un Manuscrit géographique du XVIII^e siècle, 533 †
Queensland—
Artesian wells in, 564, 566
Early Days of the Present Colony of, Reminiscences of the, by D. Forbes, 237 †
Geological Survey Reports, Index to

Queensland—*continued.*
Names of Places, Mines, etc., occurring in the, 531 †
Intercolonial Water Rights in, 769
Panoramas of Nature . . . in Southern Queensland, by H. R. Maguire, 237 †
Queensland at the beginning of the Century, by W. H. Traill, 659 †
Quijarro, Dr. A., La Cuestión de limites entre Bolivia y el Paraguay, 529 †
Quijarro, Port, Bolivia, 67
Quiroga, A., La Cruz en America (Arqueologia Argentina), 402 †
Quiros and the Discovery of Australia, 377

R.

Rabot, Ch., on the Variation in the Length of Glaciers, 194; Revue de Limnologie, 407 †
Radiolarian ooze of deep-sea deposits, 694, 697, 710
Rainfall, Influence of, on Commerce and Politics, by H. H. Clayton, 533; note on, 512
Rámishk, Persia, 131
Rampur Coalfield, Report on the, by G. F. Reader, 653 †
Ramsay, W., Ueber die Geologische Entwicklung der Halbinsel Kola in der Quartärzeit, 767 †
Rand, McNally & Co., Indexed County and Township Pocket Maps of Idaho and Georgia, 537 †; Ditto of Illinois, 787 †; Indexed Pocket Map of the Hawaiian Islands, 537 †; Ditto, Cuba, 246 †; Ditto, Florida, 247 †
Ras-el-Kheima, Northern Oman, 57
Raseri, E., La popolazione del Regno d'Italia secondo i risultati del Censimento generale, 228 †
Ratzel, Dr. F., Die Erde und das Leben, 242 †; review, 500; Die Kant-Laplacesche Hypothèse und die Geographie, 406 †; Die Lage im Mittelpunkt des geographischen Unterrichts, 241 †; Der Ursprung der Arier in geographischen Licht, 409 †
Ravenstein, E. G., Medal awarded to, 629, 648; remarks on the "Ancient Kingdom of Kongo," 558; The Strange Adventures of Andrew Battell of Leigh in Angola, etc., 772 †; review of, 745
Read, C. H., remarks on "A Fourth Journey in Persia," 170
Reclus, E. et O., L'Empire du Milieu, 768 †
Red River Valley, Physical Geography of the, by D. B. Dowling, 774 †
Red Sea—
Deutsche Kohlenstation im Roten Meere, von Major K. von Bruchhausen, 106 †
Redway, J. W., The New Basis of Geography, 410 †; review, 368
Reeves, E. A., The Deflection of the Plumb-line in India, 615
Rehbock, Prof. T., Der wirthschaftliche Werth der Subtropen in seiner Abhängigkeit von der Wasserfräge, 408 †
Reibisch, P., Ein Gestaltungsprincips der Erde, 780 †
Reinach, L. de, Le Laos, 524 †
Reinhard, Dr. R., Die wichtigsten Deutschen Seehandelsstädte, 650 †
Reliefs—
Anfertigung von Reliefs in der Schule und für die Schule, von Dr. Max Ebeling, 241 †
Reynolds, Miss J. B., Class Excursions in Wales and England, 241 †; remarks on the "Teaching of Geography," 81
Rhees, W. J., Smithsonian Miscellaneous Collections, 775 †
Rhodes, Cecil, obituary of, 644; A Study of a Career, by H. Hensman, 782 †
Rhodes, T., Jamaica and the Imperial Direct West India Mail Service, 776 †
Rhodesia—
Ancient Ruins of, by R. N. Hall and W. G. Neal, 772 †; review of, 495
Northern, Photographs of, by G. Grey, 120 †
Surveys in, 376
Travel and Trade Routes in North-Eastern Rhodesia and Adjacent Parts of East Central Africa, 598 *
Rhone Glacier—
Vermessungen am Rhone-Gletscher während 25 Jahren, von Prof. E. Hagenbach-Bischoff, 395 †
Ricchieri, Prof. G., Piccolo Annuario Geografico e Statistico compilato dal, 243 †; Tre escursioni in provincia di Messina, 650 †; e O. Marinelli, Toponomastica e Topolessigrafia, 663 †
Richter, Prof. Dr. E., Neue Beiträge zur Morphologie von Norwegen, 228 †; Der Gletschersturz von Simpeln am Marz 1901..104 †; Mathias Burgklehners Tirolische Landtafeln. Mit einem Begleittexe von, 785 †
Richthofen, Baron von, on the Structure and Divisions of the Coast of Eastern Asia, 214
Rickmers, W. R., review of Krafft's 'A Travers le Turkestan Russe,' 743
Ridgway, R., The Birds of North and Middle America, 774 †
Ries, Das, von Prof. Dr. S. Günther, 766 †
Riesengebirge—
G. B. Mendelssohn und seine Schilderung des, von P. Kämmerling, 241 †
Glacialablagerungen des Riesengebirges, von Prof. Dr. J. Partsch, 394 †
Rift Valley, Uganda Protectorate, 2, 4
Rijnhart, Susie C., With the Tibetans in Tent and Temple, 230 †
Rimatara, Annexation of, by France, 221
Rimbaud, M., Les Tiûnar' de la Gara des Chorfa, 233 †

Rinsing, Pundit, journeys in the Kangchenjunga group, 456
Rio Grande do Sul, Trade of Consular District of (Foreign Office Rep.), 109 †
River capture—
Phénomènes de capture des cours d'eau superficiels par les cours d'eau souterrains, dans les régions calcaires, par E. Fournier, 533 †; note on, 512
Rivers—
Comparison of the Flow of Water in a River with that in a Small-scale Model of the River, by T. A. Hearson, 408 †
Rivers and Lakes—
Manuscrit géographique du XVIII^e siècle, par L. Quarré-Reybourbon, 533 †
Romer, Dr. F., Auf einem deutschen Fischdampfer um Spitsbergen und König-Karlsland, 110 †
Ronaldshay, Earl of, Across the Himalayas in Mid-winter, 230 †
Rooper, T. G., On Methods of Teaching Geography, 241 †
Root, J. W., British Trade with West Africa, 400 †
Roquevaire, R. de F., Note sur le voyage au Maroc de Georges Forret, 657 †
Ross, Major R., Malaria and Mosquitos, 662 †
Rota Island—
Bericht über die Insel Rota (Marianen), von Bezirksamtmann Fritz, 237 †
Roth, Dr. E., Einige Worte über die Eiszeit, 661 †
Rouhaud, M., La moyenne Nyanga, 528 †
Roux, J. C., L'Isthme et le Canal de Suez, historique, état actuel, 399 †
Royal Asiatic Society of Great Britain and Ireland, Some Remarks on the, by R. N. Cust, 663 †
Royal Geographical Society—
Meetings of the, Session 1901–1902.. 101, 102, 226, 390, 520, 521, 647, 764
Medals and other awards, 629
Royal Scottish Geographical Society, Livingstone Gold Medal of the, 381
Royce, C. C., Indian Land Cessions in the United States, 774 †
Rózpide, R. B. y, Repertorio de Publicaciones y Tareas de la Sociedad Geográfica de Madrid, 534 †
Rud-i-Perián, Persia, 147
Rudolf, Lake, A Journey from Omdurman to Mombasa *viâ*, by Brevet-Major H. H. Austin, 669 *
Rudolf Lake Region—
'Twixt Sirdar and Menelik, by M. S. Wellby, review of, 197
Ruge, Dr. S., Die Anfänge der Kartographie von Deutschland, 393 †; on the name of Mount Everest, 653; Valentin Ferdinands Beschreibung der Azoren, 771 †
Rukwa rift-valley, 639
Russell, H. C., Current Papers, 781 †
Russell, I. C., Climate, Vegetation, and Drainage of the Cascade Mountains, 529 †
Russia(n)—
Altitudes in Asiatic Russia, Prince Kropotkin on, 634
Bibliothèque Géologique de la Russie, 228 †
Catalogue des données hypsométriques de la Russie d'Asie et en partie des pays limitrophes, par Dr. C. Hiekisch, 769 †
Empire de Russie, Nouvelle détermination de la superficie de l', par Dr. A. Tillo, 395 †
Fauna der russischen und westsibirischen Steppen in ihrer Beziehung zu der pleistocänen Steppenfauna Mittel-Europas, von Dr. A. Nehring, 394 †
Finlande, Le conflit entre la Russie et la, par J. Leclercq, 229 †
Flora der südrussischen Steppen, von Prof. A. Krassnow, 395 †
Flüsse des Europäischen Russlands, Untersuchung der Quellengebiete der, von Dr. A. von Tillo, 394 †
Geographical Society, awards of the, 513
Geographical Society, A new, 763
Handbuch für Reisende, von K. Baedeker, 228 †
Histoire, Geographie, Littérature, par E. Guénin, 228 †
Hydrographic Department, Report of the, 228 †
Manganerzlager in der Tertiären Ablagerungen des Gouvernements Jekaterinoslaw, von Dr. N. Sokolov, 394 †
Maps: Asiatic Russia (Ministry of Ways and Communications), 114 †; Hydrographic Charts, 416 †, 668 †
Polar Expedition in the *Sarya*, by Baron E. von Toll, 475 *
Populations anciennes et actuelles de la Russie méridionale et du Caucase, Origines des, par M. Zaborowski, 228 †
Rivers and forests in, M. Flahault's researches on the, 751
Russland in Asien. Historisch-wirtschaftliche Skizze, von M. Meister, 525 †
Tibet Expedition, 1899–1901, by Captain P. K. Kozloff, 576 *
Tilai-Kamen, Sur les roches éruptives du, note de MM. Duparc et Pearce, 228 †
Russian, Lake, Tibet, 594
Rusterna af Ostersjön och Kattegat, Om landhöjningen vid, af A. Bonsdorff, 650 †
Rüstringen und Wangerland am Jadebusen, von R. Hansen, 535 †; Küstenänderungen in, von Dr. H. Hansen, 766 †

Ruwenzori Range—
Ascent by Mr. Wylde, 86
Minerals and Rocks, List of, collected by Sir Harry Johnston's Expedition, 49
Plants, List of, collected by Sir Harry Johnston's Expedition, 42
Uganda Protectorate, Ruwenzori, and the Semliki Forest, by Sir Harry Johnston, 1 *
Vegetation, 30; lobelias, 31; animals, 33; glaciers, 36; tribes, 39; height, 41
Ruzi river, Sobat region, 385

S.

Sabei people of north Elgon, 16
Sahara—
Alger au Congo par le Tchad, De l', par F. Foureau, review of, 196
Artesian wells in the, 563
Colonne Servière au Tidikelt . . . de route du commandant Laquière, 772 †
Eau dans le Sahara, par M. J. Lahache, 233 †
French, Colonel Péroz's journey in the, 218
Goniatites carbonifères dans le Sahara, par M. Collott, 108 †
Maps: Carte de la Mauritanie Saharienne (Mission Coppolani), 413 †
Mission Saharienne Foureau-Lamy. D'Alger au Congo par le Tchad, par F. Foureau, 400 †
Photographs of the Algerian Sahara, by W. J. H. King, 538 †
Question transsaharienne, par MM. Simian et Huguet, 233 †
Tifinar' de la Gara des Chorfa, par M. Rimbaud, 233 †
Transsaharien, A propos du, par P. Bonnard, 400 †
Traversée du Sahara par un ballon non monté, Sur un projet de, par M. Deburaux, 772 †
Saiidabád, Persia, 165
Sailing Notes for 1900 (Russian), 242 †
Sainjon, Lieut., Le pays Antanosy, 657 †
St. Christopher Chain, On the Geological and Physical Development of the, by Prof. J. W. W. Spencer, 236 †
St. Helena, Report for 1900 (Colonial Rep.), 108 †
Saint-Jours, M., L'âge des dunes et des étangs de Gascogne, 392 †; Au Sujet des eaux de Hourtin et de Lacanau, 392 †
St. Vincent, Volcanic Eruption in, 758
Sakambunji village, Upper Kasai, 505
Sala, G., República del Perú, Apuntes de Viaje del, 403 †
Salesses, Captain E., Le chemin de fer de Sierra Leone, 658 †
Salisbury, R. D., Glacial Work in the Western Mountains, 774 †
Salt Deposit, A remarkable, by C. F. Holder, 529 †
Salwen, sources of the, 587; valley of the, 270
Samoa—
Fahrzeuge de Samoaner, von Prof. Dr. Thilenius, 237 †
Manuia Samoa! Samoanische Reiseskizzen und Beobachtungen, von R. Deeken, 659 †
Samoa, Bismarckarchipel und Neuguinea, von E. von Hesse-Wartegg, 778 †
San Blas route for canal across the Isthmus of Panamá, 330
Sandeman, E., The Burrator Works for the Water-supply of Plymouth, 395 †
Sandundu falls, Upper Kasai, 505
Sanga and Ubangi, M. D. de Pauwel's journey between the, 639
Sanga, Upper, M. Kerreman's journey in the basin of the, 755
San José, La presión atmosférica en, por E. Pittier, 530 †
San Salvador, Ancient Kingdom of Kongo, 542–547; position of, 558
Santa Cruz, Rio, Patagonia, Captain A. R. Iglesias' surveys of the, 94, 235 †
San Thomé—
Colonies Portugaises: Ile de San-Thomé, par A. Negreiros, 658 †
Del L. Fea, 773 †
São-Paulo-Ribeira Bahn, Die, 402 †
São Paulo, Das Flussgebiet der Ribeira im Staate, 775 †
Sapper, Dr. Karl, Die geographische Forschung in Mittel-Amerika im 19. Jahrhundert, 659 †; Die Alta Verapaz (Guatemala), 775 †
Sarapiqui river, Nicaragua, 319
Sarasin, Drs. P. und F., Entwurf einer Geographisch-Geologischen Beschreibung der Insel Celebes, 525 †
Sarawak, Trade of (Foreign Office Rep.), 231 †
Sardinia, Highest Point of, Prof. Lovisato's measurements, 751
Sarya Polar expedition, 475
Sauerwein, C., La vallée du Yang-tse-Kiang, 653 †
Saugy, L. de, Les mines d'or de Bong-Miu (Annam), 230 †
Saxony—
Kalender und Statistisches Jahrbuch für das Königreich Sachsen, 522 †
Scandinavia: *see* Sweden and Norway
Schanz, Moritz, Ost- und Süd-Afrika, 527 †
Schenck, Dr. A., Deutsch-Südwest-Afrika im Vergleich zum übrigen Süd-Afrika, 656 †; Les populations primitives de la Suisse, 104 †
Schimmelpfennig, Hauptmann v., Bericht über die Expedition von Ngutte II. nach Yabassi, 233 †
Schindler, F., survey of the Upper Kasai 505

Schlegel, G., The Old States in the Island of Sumatra, 525 †; note on, 754
Schlobach, Hauptmann, Die Volkstämme der deutschen Ostküste des Victoria-Nyanza, 233 †
Schlüter, Dr. O., Ueber die Aussprache des namens Kerguelen, 777 †
Schmidt, Commandant L., Le Yun-Nan, 396 †
Schmit, Dr. E. R., Eine Besteigung des Popocatepetl in Mexico im Jahre 1866.. 529 †
Schnauder, Prof. M., Astronomische Ortsbestimmungen in Kamerun, 657 †
Schnee, Dr., Ueber Ortsnamen in Bismarck-Archipel, 530 †
Schoeller, Dr. Max, Mitteilungen über meine Reise nach Aquatorial-Ost-Afrika und Uganda, 398 †
Shokalsky, J. de: *see* Shokalsky
Schrader, Dr. C., Die Bestimmung von Ortszeit und Azimut aus gleichen Sonnenhöhen, 406 †
Schrader, F., L'Année Cartographique, 414 †; Le Tachéographe, 406 †
Schulte, Dr. A., Zur Eisenbahn Victoria-Mundame, 399 †
Schulz, Dr. A., Die Verbreitung der Halophilen Phanerogamen in Mitteleuropa nördlich der Alpen, 391 †: Syriens Rolle im Welthandel, 232 †
Schulze, F., Die erste ethnographische Skizze über die Botokuden in deutscher Sprache, 109 †
Schurtz: *see* Winckler
Schurtz, H., Afrikanisches Steingeld, 773 †; Alterklassen und Männerbünde, 781 †
Schütte, Dr. L., Die Lage von Parma und ihre Bedeutung im Wechsel der Zeiten, 228 †
Schwarzer, Dr. O., Die Kunde der Entdeckung Amerikas im deutsch-slavischen Osten, 240 †
Sclater, W. L., Notes on the so-called "Post-Office" Stone . . . in the South African Museum, 773 †
Scobel, A., Neuer Volks- und Familien-Atlas in einhundert Kartenseiten, 247 †
Scotland—
Distribution of Certain Forest Trees in, by W. N. Niven, 767 †
Population en Écosse, Les influences géographiques dans la Répartition de la, par M. Privat-Deschanel, 767 †
Topographical Survey of, The First, by C. G. Cash, 104 †
Scutari Lake, exploration of the, by Prof. Cvijič, 211
Sea Coast, The, by W. H. Wheeler, 660 †; review of, 747
Sea-Mile—
Realität der Existenz der Kleinen Mittelmeer-Meile auf den italienischen Seekarten, von Dr. H. Wagner, 409 †
Sedimentation, On the Inner Mechanism of, by J. Joly, 532 †
Seebee, Felix, Travelling Impressions in Peru, 236 †
Séguin, M., Voyage d'exploration dans l'intérieur du Kuango, 233 †; note on, 89
Sehkuha, Persia, 145
Seiches—
Seiches des Lacs, par Dr. A. Forel, 407 †
Seidel, A., Das Bakwirivolk in Kamerun, 233 †; Grammatik der Japanischen Umgangssprache, 396 †
Seine—
Observations Centralisées par le Service Hydrométrique du Bassin de la Seine pendant l'Année 1899, par H. Maillet, 392 †
Selangor Administration Report, by H. C. Belfield, 106 †
Selby, P. H., Journey to the Kafue and Zumbo Districts, 605 *
Seler, Dr. E., Wissenschaftliche Ergebnisse einer . . . Reise durch Mexico und Guatemala, 775 †
Seljuks of Persia, 172
Semliki Forest, The Uganda Protectorate. Ruwenzori and the, by Sir Harry Johnston, 1 *
Semple, Miss, Photographs of Kentucky, 120 †
Senegal—
Trade of (Foreign Office Rep.), 528 †
Sergi, Prof. G., The Mediterranean Race, review of, 365
Serial Temperatures—
Methode zur bequemeren Messung von Serial-Temperaturen, von Baron von Wrangell, 407 †
Servigny, J., La Mission Marchand au point de vue médical, 398 †; La Navigation du Yang-tsé, 652 †; L'or dans le Monde, 534 †; L'or à Madagascar, 657 †
Seton-Karr, Mr., antiquarian discoveries in Somaliland, 755
Severn Bore, Cinematographing the, by Vaughan Cornish, 52 *
Seychelles—
Cenni sulle Isole Séychelles, 524 †
Report for 1901 (Colonial Rep.), 231 †
Shahristán, Persia, 146
Shanghai to Bhamo, From, by R. Logan Jack, 249 *
Sharghin-tsagan-nor, Lake, Tibet, 580
Sharp, Ven. A. F., Borneo: its Natives, Immigrants, and European Enterprises, 231 †
Sharpe, Dr. Bowdler, On a Collection of Birds made by Dr. Donaldson Smith in Northern Somaliland, 108 †; remarks on "The Uganda Protectorate," etc., 41; remarks on the "Voyage South of the *Discovery*," 451
Shaw, W. N., and R. W. Cohen, On the Seasonal Variation of Atmospheric

Temperature in the British Isles, etc., 395 †
Sherbro and its Hinterland, by T. J. Alldridge, 108 †; review of, 199
Shiráz, Persia, 134
Shire—
Schirehochlandbahn und die Afrikanischen Seengebiete, 527 †
Shokalsky, Lieut.-Colonel J. de, Le Lac de Ladoga au point de vue thermique, 394 †; Les Travaux des officiers hydrographes russes dans l'Océan Arctique et en Sibérie, 397 †; Sur les Observations du Pendule à seconde en Russie, 405 †
Shorfa—
Tifinar' de la Gara des Chorfa, par M. Rimbaud, 233 †
Siam—
Danske videnskabelige Siam Expedition, Fra den, af Dr. T. Mortensen, 397 †
History of the French Missions to, 770 †
Siang tributary of the Yang-tse, 712, 717; Siang-tan, 724; Siang-yin, 721
Siberia—
Achèvement du Transsibérien, par H. B'dou, 770 †
Colonisation en Sibérie: la Steppe Kirghize, par P. Labbé, 654 †
From Japan to Europe by the Trans-Siberian Route, by H. A. Bonar, 770 †
Haut-Amour et la Chilka, par G. Weulersse, 770 †
Maps: Sibirikows Weg von Jakutsk zum Ochotskischen Meere, 787 †
Jesup Expedition in, 215
Russischen Seenforschungen in Westsibirien, Die neuesten, von B. Adler, 397 †
Siberia, by Prof. E. Grosvenor, 106 †
Sibérie Economique, La, par C. Aulagnon, 769 †
Travaux des officiers hydrographes russes dans l'Océan Arctique et en Sibérie, par J. de Schokalsky, 397 †
Siberian Railroad, The Great, by A. M. Brice, 231 †
Sieger, Prof. Dr. R., Kanäle und Kanalprojekte in Osterreich-Ungarn, 391 †; (Biography of) Wilhelm Tomaschek, 782 †
Sieglin, W., Entdeckungsgeschichte von England im Alterthum, 395 †
Sierra Leone—
Chemin de fer de Sierra Leone, par le Capitaine E. Salesses, 658 †
Sherbro and its Hinterland, by T. J. Alldridge, 108 †; review of, 199
Sievers, Dr. W., und Dr. F. Hahn, Afrika, Zweite Auflage, 771 †
Sikhota-alin, description of the, by Ivanhoff and Batsévich, 215
Sikkim—
Himalaya of, 454; Valleys and glaciers of the, 474
Reise im unabhängigen Sikkim, von P. L. Bodsohn, 396 †
Silesia—
Geologische Exkursion des XIII. Deutschen Geographentages nach Oberschlesien, von Dr. F. Frech, 394 †
Simian et Huguet, MM., La question transsaharienne, 233 †
Simond, C., Les Français en Afrique au XIX^e Siècle, 398 †
Singapore, Map of the Island of, and its Dependencies, by J. Van Cuylenburg, 786 †
Singer, H., Die Polarforschung im Jahre 1901..532 †; Der Stand der Abgrenzung unserer afrikanischen Schutzgebiete, 528 †
Siniolchum peak, Himalayas, 466
Sin-kai, Chinese name for Bhamo, 273
Sirdar and Menelik, 'Twixt, by the late Captain M. S. Wellby, review of, 197
Sirján, Persia, 165, 166
Sistán, plain of, Persia, 141, 145, 172
Siwa, Journey from Farafra to, 1898, by W. Jennings-Bramly, 73*; Report on the Oasis of, by T. B. Hohler, 232 †
Six, G., L'Eifel, région montagneuse de la rive gauche du Rhin, 393 †
Skagi peninsula, Iceland, 613
Skeel, Caroline A. J., Travel in the First Century after Christ, 239 †
Slav Race—
Verbreitung, Eintheilung, und Ursprung der slavischen Völkerstämme, von Dr. Buschan, 523 †
Slavery—
Sklaverei als ein Wirtschaftssystem, von Dr. A. Vierkandt, 782 †
Smith, A. H., China in Convulsion, 652 †
Smith, Dr. G., Foreign Mission Atlas, 415 †
Smith, Major-General Sir R. M., the life of, by W. K. Dickson, 112 †
Smith, Prof. G. A., Notes of a Journey through Hauran, 232 †
Snow—
Beobachtungen über das Schwinden einer Schneedecke, von Dr. J. Westmann, 532 †
Sobat—
Correspondence on the, 520
Escursione sul basso Sobat, lettera del padre L. Tappi, 528 †
Hydrography of the, Letter from Major H. H. Austin on the, 385
Soils, On the Reason for the Retention of Salts near the Surface of, by T. H. Means, 661 †
Sokolov, Dr. N., Die Manganerzlager in den Tertiären Ablagerungen des Gouvernements Jekaterinoslaw, 394 †
Sollas, Prof. W. J., Rate of increase of Underground Temperature, 239 †
Solomon Islands—
Discovery of the, by Lord Amherst and B. Thomson, 778 †
Somaliland—
Antiquarian discoveries in, by Mr Seton-Karr, 755

Somaliland—*continued.*
Birds, Collection of, made by Dr. Donaldson Smith in Northern Somaliland, On a, by R. Bowdler Sharpe, 108 †
French : Le Chemin de fer de Djibuti à Harar, 656 †
Jibuti to Lamu, Count Wickenburg's journey from, 216
Native Caravan, Journey of a, through, 374
Somalia Italiana, del G. Pestalozza, 656 †
Somme—
Falaises vives et Falaises mortes de la, 649 †
Les transformations du littoral de la, 227 †
Son Valley, Geological History of the, Mr. R. D. Oldham on the, 84, 230 †
Sonyo, Congo, 542
Souffrière, St. Vincent, Eruption of, 758
Soulé, Frank, Joseph Le Conte in the Sierra, 662 †
Soulsby, Basil H., The First Map containing the Name America, 201 *
South Seas : *see* Pacific
Southern ocean, deep-sea deposits of, 696
Spain—
Existence de phénomènes de recouvrement dans la zone subbétique, par M. R. Nicklès, 767 †
Mission de la Société d'océanographie en Espagne et en Portugal, par G. Desbats, 767 †
Speak, S. J., The Gold-producing Region of West Africa, 658 †, 773 †
Spellenberg, G., Bericht über meine dritte Reise ins N.-W.-Gebiet des Hinterlandes von Kamerun, 107 †; Ein Beitrag zur Land- und Völkerkunde von Kamerun-Hinterland, 657 †
Spencer, Prof. J. W. W., On the Geological and Physical Development of Anguilla, 235 †; ditto of Antigua, 235 †; ditto of Guadeloupe, 236 †; ditto of the St. Christopher Chain, 236 †
Spilsbury, Major, Expedition from Port Amelia to Lake Nyassa, 400 †
Spitaler, Dr. R., Die periodischen Luftmassenverschiebungen, etc., 661 †; Linien gleichen Unterschiedes des wahren Luftdrucks in Januar und Juli, 247 †
Spitsbergen—
Bidrag till Kännedomen om Spitsbergens och Beeren Eilands Kärlväxtflora, af Gunnar Andersson och H. Hesselman, 532 †
Expédition suédoise au Spitzberg en 1898 pour la mésure d'un arc du méridien, par V. Carlheim-Gyllensköld, 532 †
Fischdampfer um Spitsbergen und König-Karlsland, Auf einem deutschen, von Dr. F. Romer, 110 †
Gletscher von, von Prof. G. de Geer, 405 †
Spitzbergen—*continued.*
Två Somrar i Norra Ishafvet, af A. G. Nathorst, review of, 80
Sprigade, Paul, und Max Moisel, Grosser Deutscher Kolonialatlas, 116 †
Stanford's Compendium of Geography and Travel. Central America and the West Indies, by A. H. Keane, 530 †
Stanley Falls Region, Railways in the, 374; Le chemin de fer des, par A. J. Wauters, 771 †
Stanley, Sir H. M., remarks on "The Uganda Protectorate, etc.," 40
Stanmore, Lord, remarks on "The Formation of the Maldives," 298
Stassano, H., Démonstration géographique de l'origine terrestre des aurores polaires, 111 †
Stavenhagen, W., Über die englische Landesaufnahme in Europe und Vorder-Indien, 532 †; Der Wert der Mandschurei für Russland, 524 †
Steele, L. J., In the Heart of the Canadian Rockies, 529 †
Steenstrup, K. J. V., Beretning om en Undersøgelsesrejse til Øen Disco Sommeren 1898..405 †; note on, 379
Stein, Baron von, expedition in the Southern Kamerun, 218, 399 †, 638, 657 †
Stein, M. A., Preliminary Report on a Journey of Archæological and Topographical Exploration in Chinese Turkestan, 769 †
Stenin, P. v., (Biography of) Generalmajor M. I. Wenjukoff, 112 †; Die Talabskischen Inseln auf dem Pleskauer See, 523 †
Stephani, F., Beiträge zur Lebermoos-Flora Westpatagoniens und des südlichen Chile, 530 †
Stephens and Christophers, Messrs., Malaria Investigations in Bengal, 753
Stettin—
Geologie und Morphologie der Umgebung Stettins, von Dr. Keilhack, 522 †
Stevens, B. F., Facsimile of the Unpublished British Head Quarters Coloured Manuscript Map of New York, 414 †
Stevens, H. N., on the first map containing the name America, 205
Stieler's Hand-Atlas, Neue, neunte Lieferungs-Ausgabe von, 116 †, 247 †, 537 †, 666 †, 787 †
Stileman, Rev. C. H., The Subjects of the Shah, 769 †
Stoll, Dr. O, Über xerothermische Relikten in der Schweizer Fauna der Wirbellosen, 523 †
Stone Age—
Materiali per lo studio della "Età della Pietra" dai tempi preistorici all' epoca attuale, per E. H. Giglioli, 661 †
Stopford, Colonel J. G. B., Glimpses of Native Law in West Africa, 400 †

Stradelli, E., Mappa Geographico do Estado do Amazonas, 246 †
Stromer, Dr. E., on the past history of Tanganyika, 507; Ist der Tanganyika ein Relikten-See? 773 †
Stromeyer, C. E., Surface Equivalent Projections, 406 †
Struck, A., Philippi, 229 †; Zur Geschichte der Eisenbahnen Griechenlands, 650 †
Stübel, Dr. A., Geographische Verbreitung der hauptsächlichsten Eruptionszentren, 537 †
Stuhlmann, Dr. F., Aufnahmen im Gebiet des Albert- und Albert-Edward-Sees, während der Emin Pascha-Expedition, von Max Moisel, 536 †
Sturm, Dr. F., Die Entstehung der Wasserfälle, 239 †
Stutfield, H. E. M., Mountain Travel and Climbs in British Columbia, 528 †
Sudan—
  Notes for Travellers and Sportsmen in the, 234 †
Sudan-Abyssinian Frontier, Surveys on the Proposed, by Major C. W. Gwynn, 656 †
Suess, Ed., Das Antlitz der Erde, 111 †
Suez Canal—
  Isthme et le Canal de Suez, historique, état actuel, par J. C. Roux, 399 †
Suk tribe, Uganda Protectorate, 9
Sumatra—
  Ancient States of, Mr. G. Schlegel on the, 754
  Auf Java und Sumatra, von Dr. K. Giesenhagen, 769 †
  Journey across, by Major Van Daalen, 635
  Neuesten Fortschritte der Kenntnis von, von Dr. C. M. Kan, 769 †
  Old States in the Island of Sumatra, by G. Schlegel, 525 †
Sumbu, Lake Tanganyika, 601
Sun, Tables of the Corrected Azimuths of the, 110 †
Sung-pan, China, 255
Supan, Dr. A., Das antarktische Klima, 660 †
Superville, M., explorations in the Northern Ubangi basin, 89
Surrey—
  Gravel-Flats of Berkshire and, On the Origin of the, by H. W. Monckton, 229 †
Surveying—
  Hammer-Fennel'sche Tachymeter-Theodolit, von Dr. E. Hammer, 660 †
  Topographic Surveying, by H. M. Wilson, review of, by Colonel Sir T. H. Holdich, 75
Surveys—
  Englische Landesaufnahme in Europe und Vorder-Indien, Über die, von W. Stavenhagen, 532 †
Susa, Explorations at, by W. Boscawen, 769 †
Sushitna river, Alaska, 611
Sutherland, A., De Quiros and the Discovery of Australia, 530 †
Suvadiva, Maldive islands, 281
Swahili—
  Schilderungen der Suaheli von Expeditionen v. Wissmanns, Dr. Bumillers, Graf v. Götzens, und Anderer, von Dr. C. Velten, 398 †
Sweden—
  Pflanzenleben in nordschwedischen Hochgebirgen, von A. Cleve, 523 †
Sweden and Norway—
  Peat Fuel in Scandinavia, by A. Bache, 395 †
Swedish Antarctic Expedition, 761
Sweet-Escott, —, Seychelles, Report for 1901 (Colonial Reports), 231 †
Swenander, G., Beiträge zur Fauna der Bären-Insel, 531 †
Switzerland—
  Allmenden des alten Landes Schwyz, von T. Felber, 523 †
  Altersfrage des Löss, von A. Gutzwiller, 523 †
  Annuaire Statistique de la Suisse, 523 †
  Anthropologie des populations primitives de la Suisse, par Dr. A. Schenk, 104 †
  Bergreisen und Bergsteigen in der Schweiz vor dem 19. Jahrhundert, von Dr. H. Dübi, 104 †
  Carte murale de la Suisse pour les écoles, par Colonel J. J. Lochmann, 104 †
  Ghiacciai del Bernina, dal Prof. L. Marson, 523 †
  Gletschersturz von Simpeln am 19. März 1901, von E. Richter, 104 †
  Populations primitives de la Suisse, par Dr. A. Schenk, 104 †
  Schweizerischer Torfmoore, Beiträge zur Kenntnis, von E. Neuweiler, 229 †
  Xerothermische Relikten in der Schweizer Fauna der Wirbellosen, von Dr. O. Stoll, 523 †
Sykes, Major P. Molesworth, A Fourth Journey in Persia, 1897–1901 .. 121 *; medal awarded to, 629, 647; Photographs of Persia, 248 †
Symi, L'Isle de, par H. Hauttecœur, 397 †
Syria—
  Syriens Rolle im Welthandel, von Dr. Schulz, 232

T.

Tachéographe, Le, par F. Schrader, 406 †
Taftan mountain, Persia, 139
Taimyr peninsula, 478
Tai-ping Ho, Yunnan, 271
Takht-i-Tanbur, Persia, 166
Talmage, Prof. J., The Great Salt Lake, 529 †

Talung glacier, Kangchenjunga, 457
Tamborini, F., Die Einwirkung des Menschen auf die Natur, 240 †
Tanana river, Alaska, 610; Navigation of the, 757
Tanganyika—
Fishes, Collection of, made by Mr. Moore in 1899–1900, Report on, by G. A. Boulenger, 234 †
Geological Notes from Tanganyika Northwards, by M. Fergusson, 232 †
Ist der Tanganyika ein Relikten-See? von Dr. E. Stromer, 773 †
Journey from Domira Bay to Fife on the Tanganyika Plateau, by Ch. McKinnon, 603 *
Past History of, Dr. E. Stromer on the, 507
Trade Routes to, 603
Voyage on, A, by R. Codrington, 598 *
Tarr, R. S., The Teaching of Geography, 783 †
Tatsyp-nor, Tibet, 580
Taufikia Station, Nile river, 690
Taveta, People of, Notes on the History and Customs of the, by Claud Hollis, 398 †
Taylor, C. M., Touring Alaska and the Yellowstone, 108 †
Taylor, Dr. John Stopford, obituary of, 100
Tea Plant, The Geographical Distribution of the, by J. McEwan, 408 †
Tehúantepec, Isthmus of—
Interoceanic route across, 324
Railway of, by Mrs. Alec Tweedie, 234 †
Telezkoie, Lake, in the Altai, Ignatov's explorations of, 370
Temple, Sir Richard, obituary of, 644
Teng-yueh, Yunnan, 270
Terrestrial Magnetism—
Secular Motion of the Earth's Mean Magnetic Axis, Note on the, by L. A. Bauer, 112 †
Terrier: *see* Dubois
Terrigenous Deposits, composition of, 692, 698
Texas—
Coast Prairie of, by R. T. Hill, 402 †
Lost Boundary of, by M. Baker, 529 †
Theobald, F. V., A Monograph of the Culicidæ, or Mosquitoes, 781 †
Thiele, Dr. O., Die Volksverdichtung im Regierungsbezirk Aurich, 393 †
Thilenius, Prof. Dr., Die Fahrzeuge der Samoaner, 237 †
Thimm, C. A., Hindustani Self-taught with English Phonetic Pronunciation, 783 †
Thomann, G., À la Côte d'Ivoire: La Sassandra, 399 †
Thomas, Margaret, Denmark Past and Present, 765 †
Thomas, Oldfield, On the more notable Mammals obtained by Sir Harry Johnston in the Uganda Protectorate, 108 †
Thomson, Captain W. C., H.M.S. *Lady Nelson*, 530 †; Notes *re* the Supposed Ancient Wreck near Warrnambool, 403 †
Thomson, J. P., An Account of Lord Lamington's Travels in Mexico, 234 †; award to, 630, 648; The Climate and Artesian Waters of Australia, 659 †; The Geographical Evolution of the Australian Continent, 236 †
Thoroddsen, Dr. T., Geological Map of Iceland, 411 †; Islandske Fjorde og Bugter, 394 †; note on, 612
Thoulet, Prof. J., Carte Lithologique sous-marine des Côtes de France, 113 †; Classification des Fonds sous-marins, etc., 407 †; Conférence internationale pour l'étude de la mer, 111 †; Étude de fonds marins provenant du voisinage des Açores, etc., 533 †; Sur le mode de récolte des échantillons du sol sous-marin, 533 †; La transparence et la couleur de la mer, 533 †, 781 †; and H. Arçtowski, Expédition Antarctique Belge. Résultats du Voyage du S. Y. "Belgica." Océanographie, 404 †
Thuringia—
Geologische und meteorologische Motive einiger an Thüringer Seen geknüpften Sagen, von W. Krebs, 649 †
Tian Shan, Expedition to, by Dr. M. Friederichsen, 754
Tibet—
Journey across, Dr. Sven Hedin's, 502
Natives of, 590, 591
Russian Tibet Expedition, 1899–1901, by Captain P. K. Kozloff, 576 *
With the Tibetans in Tent and Temple, by Susie C. Rijnhart, 230 †
Tidal Bore, The Solution of the Problem of the, by A. Brownlie, 408 †
Tientsin—
Tien-tsin après la défaite des Boxeurs, par M. V. de Laguérie, 230 †
Tight, W. G., Preglacial Drainage in South-Western Ohio, 402 †
Tillo, Dr. A., Untersuchung der Quellengebiete der Flüsse des Europäischen Russlands, 394 †; Nouvelle détermination de la superficie de l'Empire de Russie, 395 †
Time and Azimuth—
Ortszeit und Azimut aus gleichen Sonnenhöhen, Die Bestimmung von, von Dr. C. Schrader, 406 †
Tippenhauer, L. G., Beiträge zur Geologie Haïtis, 402 †
Tirol—
Bozener Land, Das, von J. Jaeger, 391 †
Tissot et Hallion, MM., Les phénomènes physiques et chimiques de la respiration à différentes altitudes, pendant une ascension en ballon, 534 †
Tiz, Persia, 133 *and note*
Todd, Kapitän, Die Reise des amerikanischen Kanonenbootes Wilmington auf dem Amazonen strom, 109 †

Toll, Baron E. von, Arctic Expedition of, 221, 510; The Russian Polar Expedition in the *Sarya*, 475 *
Tomaschek, Wilhelm, von Dr. R. Sieger, 782 †
Tonkin—
Maps: Tonkin et Haut Laos par le Commandant Friquegnon, 786 †
Torquatus, Georg, als ältester Halberstädter Topograph, von A. Berg, 534 †
Torres Straits—
Cambridge Anthropological Expedition to, Reports of the, 238 †
Toscanelli, La Lettre et la carte de, sur la route des Indes par l'Ouest, etc., par H. Vignaud, 240 †; review of, 749; Toscanelli, Colombo e la leggenda del Pilota, del Prof. G. Uzielli, 782 †; Lettre et la carte de Toscanelli, Vignaud's, par H. Wagner, 782 †
Traill, W. H., Queensland at the beginning of the Century, 659 †
Transcaspian—
Raccordement du Transcaspien, par G. V., 654 †
Trans-Siberian Railway, progress of the, 216
Transvaal—
Géologie du Transvaal d'après M. Molengraaff, 658 †
Travel in the First Century after Christ, with special reference to Asia Minor, by Caroline A. J. Skeel, 239 †
Travertine Falls and Reefs, The Origin of, by Prof. J. C. Branner, 111 †
Trent—
Photographs of the "Aegir" on the Trent at Gainsborough, by C. L. Weller, 539 †
Trinidad Island, *Discovery's* visit to, 426; rocks and plants of, 432; petrels of, 452
Tripoli—
Explorations in, by M. de Mathuisieulx, 88
La Tripolitania, F. Minutilli, 400 †
Trollope, Rev. M. N., Kang-wha, 654 †
Tronquoy, G. du, De la formation des lagunes dites "Limans" des environs d'Odessa, 651 †
Trübner, Dr. K., Minerva. Jahrbuch der gelehrten Welt, 243 †
Tschulok, S., Das Moskauer Industriegebiet und der Oberlauf der Wolga, 650 †
Tsetse Fly—
Versuch zur Immunisirung von Rindern gegen Tsetsekrankheit, von R. Koch, 398 †
Tunis—
Chemins de fer tunisiens devant le Parlement, par H. Pasquier, 234 †
Grands Domaines franco-tunisiens, par G. de Beaumont, 400 †
Maps: Tunisie (Service Géo. de l'Armée), 115 †
Politique Coloniale, La, L'invasion sicilienne en Tunisie, par E. Menager, 108 †
Tunis—*continued.*
Tunisie en 1900, par la Commandant D. Bordier, 108 †
Utilisation des travaux hydrauliques des Romains en Tunisie, par G. Wolfrom, 234 †
Tuolumne and Cathedral Cañons, In, by A. G. Eells, 774 †
Turialba volcano, Costa Rica, 318
Turkestan—
A travers le Turkestan Russe, by Hugues Krafft, review of, by W. R. Rickmers, 743
Reise nach West-Turkestan und in den Centralen Tien-Shan, von Dr. G. v. Almásy, 395 †
Turkestan Russe, A travers le, par H. Krafft, 654 †
Voyage en Turkestan et en Dzoungarie en 1898, par O. Donner, 652 †
Turkey—
Coal and Petroleum Deposits in European Turkey, by Lieut.-Colonel T. English, 767 †
Turks and Caicos Islands, Report for 1900 (Colonial Rep.), 110 †
Turkwell river, East Central Africa, 683
Turner, Hon. J. H., British Columbia of To-day, 773 †
Turquan, V., La population de la France d'après les résultats du recensement de 1901..649 †
Tweedie, Mrs. Alec, Mexico as I saw it, 234 †; The Isthmus of Tehuantepec Railway, 234 †
Tyrol—
Maps: Mathias Burgklehners Tirolische Landtafeln. Mit einem Begleittexte, von Dr. E. Richter, 785 †

U.

Ubangi—
Dans le Haut-Oubangui, par M. A. T., 528 †
French Explorations in the northern basin of the, 89
Uganda—
Mammals obtained by Sir Harry Johnston in, On the, by Oldfield Thomas, 108 †
Mombasa-Victoria (Uganda) Railway Committee, Report by the, on the Progress of the Works, 658 †
People of, 21
Protectorate, Ruwenzori, and the Semliki Forest, by Sir Harry Johnston, 1 *; Mineral Specimens from the, collected by Sir Harry Johnston's expedition, 43
Railway, by Sir G. Molesworth, 658 †
Uhlig, Dr. Carl, Ascent of Mounts Kilimanjaro and Meru, 755
Ujiji, Lake Tanganyika, 599
Ukamba, Mr. Ainsworth's report on, 216
Ule, Dr. W., on the Würmsee or Starnbergersee, 381

Umbrian Towns, The, by J. W. and A. M. Cruickshank, 394 †
Umvumvumba river, Manika, 373
Underground Temperature, Rate of Increase of, by Prof. W. J. Sollas, 239 †
Underground waters—
Structure des réseaux hydrographiques souterrains dans les régions calcaires, par M. Fournier, 781 †
Ungwala or Ischeno Mountain, East Central Africa, 672
United Kingdom—
Atmospheric Temperature in the British Isles, On the Seasonal Variation of, by W. N. Shaw and R. W. Cohen, 395 †
Britain and the British Seas, by H. J. Mackinder, 523 †; review, by Dr. H. R. Mill, 489
British Forestry, The Sad Plight of, by Sir Herbert Maxwell, 104 †
Entdeckungsgeschichte von England im Alterthum, von W. Sieglin, 395 †
Influence of the Mediterranean Peoples in Prehistoric Britain, by Prof. W. Boyd Dawkins, 395 †
Lakes, British, Sir John Murray's survey of, 369
Maps: The British Isles, by Hirschberg and Oestergaard, 243 †
Ordnance Survey Revised Map, 784 †
Population en Angleterre au cours de XIX^e siècle, Répartition de la, par P. Lavagne, 395 †
Rain over the British Isles during 1900, On the Distribution of, compiled by H. S. Wallis and Dr. H. R. Mill, 229 †
Tide Tables for the British and Irish Ports for 1902, by Captain Harris and Commander Havergal, 104 †, 229 †
United States—
Agricultural Exports of the, Distribution of, by F. H. Hitchcock, 109 †
Artesian wells in the, 564
Boundaries of the, by Prof. J. B. Moore, 401 †
Buoyage, Uniform System of, as adopted by various Maritime Nations, by Lieut. T. A. Kearney, 787 †
Entwickelung der Vereinigten Staaten von Amerika, von R. Blum, 774 †
Ethnology, Annual Report of the Bureau of, by J. W. Powell, 401 †, 774 †
Geographic Names, United States Board on, 384
Geographical Publication, New, published in the, 383
Geological Survey, Annual Report of the, 401 †
Glacial Work in the Western Mountains, by R. D. Salisbury, 774 †
Ice Caves and Frozen Wells in the, Mr. Kimball's study of, 220
Indian Land Cessions in the, by C. C. Royce, 774 †
United States—*continued*.
Maps: Hydrographic Charts, 119 †, 248 †, 416 †, 538 †, 668 †, 787 †
Population: Centre of, and its Median Point, 235 †; Population of the, by Sex, Nativity, and Race, by H. Gannett, 402 †; Sex, Nativity, and Colour of the People of the, 529 †; Urban Population in 1906, Twelfth Census of the, 529; note on, 445
Relief-model of the, proposed, 508
Smithsonian Miscellaneous Collections, by W. J. Rhees, 775 †
Topographic Forms of the, by H. M. Wilson, 401 †
Unyoro, Uganda Protectorate, 21
Upham, W., The Divisions of the Ice Age, 661 †
Uspallata pass, railway through, 214
Ust-Tsylma, Pechora district, 369

V.

Vaisali, and other places mentioned by the Buddhist pilgrims, Supplement to Note on, by W. Hoey, 396 †
Van Baren, J., Description géographique de la Hollande au sud du Lek et de la nouvelle Meuse, au moyen âge, 650 †
Van Cuylenburg, J., Map of the Island of Singapore and its Dependencies, 786 †
Van Daalen, Major, journey across Sumatra, 635
Vandelet: *see* Gervais-Courtellemont
Van der Chijs, J. A., Dagh-Register gehouden int Casteel Batavia, 653 †
Van der Kemp, P. H., De Nederlandsche Factorijen in vóór-Indië in den aanvang der 19^e eeuw, 653 †
Vasco da Gama, Second Voyage of, 643
Vas'yugan tundra, Siberia, 635
Vaughan, J. D. W., Fiji—Meteorological Observations taken at Siwa, 530 †
Veeren, F. E. L., De Groenlosche Slinge en haar stroomgebied boven het dorp Winterswijk, 228 †
Velten, Dr. C., Schilderungen der Suaheli von Expeditionen v. Wissmanns, Dr. Bumillers Graf v. Götzens und Anderer, 398 †
Venezuela—
Geographical Results of the Venezuela-British Guiana Boundary Dispute, by M. Baker, 403 †
Venukoff, Generalmajor M. I. (Biography), von P. v. Stenin, 112 †
Verwilghen, R. P., A travers le Desert du Gobi, 230 †
Vesuvius—
Influence du Vésuve sur l'air des environs, par G. Melander, 650 †
Victoria City, Hong-Kong, Plan of (Public Works Department), 245 †
Victoria, Intercolonial Water Rights in, 760
Victoria Nyanza, islands of the, 18

Victoria Nyanza, To the, by the Uganda Railway, by Commander B. Whitehouse, 771 †
Victoria Regina Atlas, by W. and A. K. Johnston, 116 †
Vidal de la Blache: *see* De la Blache
Vienna—
Meteorologie von Wien, von J. Hann, 103 †
Vigener, F., Bezeichnungun für Volk und Land der Deutschen vom 10. bis zum 13. Jahrhundert, 650 †
Vignaud, H., La Lettre et la Carte de Toscanelli sur la route des Indes par l'Ouest, etc., 240 †; review, 749
Vilkitsky, Col., expedition to the Kara Sea under, 378
Vincent Pinzon, La rivière, par P. Vidal de la Blache, 659 †
Vogelsang, Dr. K., Wege-Aufnahmen im nördlichen Teil der Provinz Chi-li, 245 †
Vohsen, E., Die belgischen Eisenbahn-Projekte am oberen Kongo und die deutsch-ost-afrikanische Seenbahn, 232 †
Voigt, Dr. E., Wann erfolgte der Untergang der Andréeschen Polarexpedition? 404 †
Volkens, Dr. G., Einige Ergebnisse einer Reise nach den Karolinen und Marianen, 777 †
Vosges—
Seen der Westvogesen, von L. G. Werner, 395 †
Voss, Mr. Kemper, on the Congo-Zambezi water-parting, 176
Vredenburg, E., Description of North-West Baluchistan, 632; A Geological Sketch of the Baluchistan Desert and part of Eastern Persia, 395 †; Recent Artesian Experiments in India, 396 †; note on, 212

W.

Waddell, L. A., The Tribes of the Brahmaputra Valley, 396 †
Wagner, Dr. H., Die Realität der Existenz der Kleinen Mittelmeer-Meile auf den italienischen Seekarten, 409 †; Geographisches Jahrbuch, 243 †; Vignaud, Henry, La lettre et le carte de Toscanelli, 782 †
Wahabis, The, their Origin, etc., by Rev. S. M. Zwemer, 651 †
Wahnschaffe, Dr. F., Die Ausbildung und Gliederung der Glacial-Bildungen des norddeutschen Flachlandes, 393 †
Wainád, Goldfields of, by H. H. Hayden and F. H. Hatch, 653 †
Wakefield, Rev. Thomas, obituary of, 224
Waldron, F. W., On the Appearance and Disappearance of a Mud Island at Walfish Bay, 234 †; note on, 218
Waldseemüller, Martin, early maps by, containing the name America, 203; his "Solidum," letter from G. G. Chisholm on, 389
Wales—
Geography of, intended chiefly for use in Welsh Schools, by A. E. L. Hudson, 651 †
Wales, by O. M. Edwards (Story of the Nations Series), 651 †
Walfish Bay—
Mud Island at, On the Appearance and Disappearance of a, by F. W. Waldron, 234 †; note on, 218
Walker, Colonel R. S. F., Perak Administration Report, 105 †
Walker, H. de R., The West Indies and the Empire, 529 †
Wallach, H., Map of the Gold Coast, etc., 665 †
Wallas, Mr. Graham, remarks on the Teaching of Geography, 82
Wallis, H. S., and Dr. H. R. Mill, On the Distribution of Rain over the British Isles during 1900..229 †
Walter, Prof. Dr., Arabischen Tauschhandel in Norddeutschland, 393 †
Warburg, Dr. O., Einführung einer gleichmässigen Nomenklatur in der Pflanzengeographie, 408 †
Ward: *see* Huntingdon
Ward, Lieut. G. L. S., Military Report on the Mishmi Country, 653 †
Warneck, Captain, Russian Arctic Ocean Expedition under, 762
Warrnambool, Notes *re* the Supposed Ancient Wreck near, by Captain W. C. Thomson, 403 †
Waterfalls—
Entstehung der Wasserfälle, von Dr. F. Sturm, 239 †
Water-levels, Apparatus for recording, 222
Waterstradt, John, ascent of Gunong Tahan, 213
Watson, Colonel, remarks on "A Journey from Omdurman to Mombasa," 689
Watt, S., Vocabulary of the Kikamba Language, 655 †
Wauters, A. J., Exploration de la section Septentrionale de la chaîne des Mitumba le long des lacs Tanganika et Kivu, 398 †; Le Lomami Inférieur, 246 †; Le chemin de fer des Stanley Falls, 771 †
Waves, Dr. Cornish on, note on, 380
Weather—
Weather Prediction for a Long Time Ahead, On the Possibility of, by Prof. Dr. E. Wölfling, 112 †
Weatherley, P., Photographs of British Central Africa, 119 †
Weightman, W. J., The Nilgiri Mountain Railway, 396 †
Weissgerber, Dr. F., Itinéraire de Casablanca aux Beni-Meskin, 400 †; note on, 88
Wellby, Captain M. S., 'Twixt Sirdar and Menelik, review of, 197

Wellcome's Photographic Exposure Record and Diary, 662 †
Weller, C. L., Photographs of the "Aegir" on the Trent at Gainsborough, 539 †
Weltgeschichte. Westasien und Afrika, von Dr. H. Winckler, Dr. H. Schurtz, und K. Niebuhr, 240 †
Wendt, A. F., El Distrito minero de plata de Potosi, Bolivia, 658 †
Werner, L. G., Die Seen der Westvogesen, 395 †
Werth, Dr. E., Lebende un jungfossile Korallenriffe in Ost-Afrika, 527 †
Western Continent: *see* America
West Indies—
Stanford's Compendium of Geography and Travel. Central America and West Indies, by A. H. Keane, 530 †; review of, by Colonel G. E. Church, 622
Steamers, new lines of, from United States, 377
Volcanic Eruption in the, 758
West Indies and the Empire, by H. de R. Walker, 529 †
Westmann, Dr. J., Einige Beobachtungen über das Schwinden einer Schneedecke, 532 †
Westphal, Dr. A., Das Mittelwasser der Ostsee, 407 †
Westropp, T. J., The Cahers of County Clare: their Names, etc., 523 †
Wenlersso, G., Le Haut-Amour et la Chilka, 770 †
Wharton, Admiral Sir W. J. L., remarks on "The Formation of the Maldives," 296
Wheeler, W. H., The Sea-Coast, review of, 747
White, J., Geographical Survey of Canada, 658 †
White river, Alaska, 610
Whitehouse, Commander B., To the Victoria Nyanza by the Uganda Railway, 771 †
Wiedemann, Dr. M., Ergebnisse einer wirtschaftgeographischen Studienreise nach Australien, 403 †
Wienerwald—
Veränderungen der Topographie im Wiener Walde und Wiener Becken, von Dr. A. Grund, 648 †
Wieser, Dr. F. v., Die älteste Karte mit dem Namen "America," etc., 661 †; note on, 203
Willcocks, W., The Nile Reservoir Dam at Assuân and After, 655 †
Williams, A. V., visits to the Ancient Gem-workings in Manika, 372
Williams, C. J. R., On Some Effects of Land Floods in a Tidal River, 404 †
Willis, J. C., Note on the Flora of Minikoi, 653 †; and J. S. Gardiner, The Botany of the Maldive Islands, 653 †
Wilser, Dr. L., Rassen und Völker, 409 †
Wilson, A. W. G., on the Physical Geography of Central Ontario, 376
Wilson, H. M., Topographic Forms of the United States, 401 †; Topographic Surveying, review of, by Colonel Sir T. H. Holdich, 75
Wilson, Sir C. W., Recent Investigations in Moab and Edom, 770 †
Winckler, Dr. H., Dr. H. Schurtz, und K. Niebuhr, Weltgeschichte, 240 †
Wind-Action—
Geologischen Wirkungen des Windes, Ueber die, von Prof. Dr. Credner, 532 †
Windermere and Morecambe Bay, Reduced Ordnance Survey of, by J. Bartholomew, 535 †
Windward, New Voyage of the, 762
Winter, Sir F. P., Notes on a Government Expedition . . . to the Main Range, British New Guinea, 237 †; note on, 95
Wirgman, Rev. Dr., The First British Settlers in South Africa, 108
Witherby, H. F., Bird Hunting on the White Nile, 656 †
Witwatersrand Goldfields, New Map of the, compiled by the Chartographic Co., 665 †
Woeikow, Dr. A., Die Seespiegelschwankung zwischen Aralsee und Baraba und die Brücknersche Hypothese, 397 †; on the changes of level in the Aral sea, 503
Wölfling, Prof. Dr. E., On the Possibility of Weather Prediction for a Long Time Ahead, 112 †
Wolfrom, G., L'Utilisation des travaux hydrauliques des Romains en Tunisie, 234 †
Wolkenhauer, W., Sir John Murray, 662 †
World—
Weltgeschichte, Westasien und Afrika, von Dr. Winckler, Dr. Schurtz, und K. Niebuhr, 240 †
Wragge, C. L., Suggestions for the Establishment of a Federal Weather Bureau for the Commonwealth of Australia, 403 †; The Snowy Ranges of Australia, 237 †
Wrangell, Baron von, Methode zur bequemeren Messung von Serial-Temperaturen, 407 †
Wrangell, Mount, Alaska, 610
Wright, C. T. H., German Methods of Development in Africa, 399 †
Wundt, Theodor und Maud, Engadin-Ortler-Dolomiten, 103 †
Würmsee or Starnbergersee, Dr. W. Ule on the, 381
Wu-shwei river, China, 732
Wylde, Mr., Ascent in the Ruwenzori Range, 86

Y.

YALUNG glacier, Kangchenjunga, 457
Yamasaki, Dr. N., Erdbebenforschung in Japan, 231 †

Yangtse—
From the Yang-tse Kiang to the China Sea, by W. B. Parsons, 711 *
Navigation du Yang-Tsé, par J. Servigny, 652 †
Rapids, ascent of the, by Lieut. Hourst, 214
Rapids of the, 276
Steam Traffic and Trade on the Upper, 230 †
Vallée du Yang-tse-Kiang, par C. Sauerwein, 653 †
Yao Language, A Handbook of the, by Rev. A. Hetherwick, 655 †
Year-book—
Annuaire pour l'an 1902, publié par le Bureau des Longitudes, 663 †
Geographisches Jahrbuch, von H. Wagner, 243 †
Minerva. Jahrbuch der gelehrten Welt, von Dr. K. Trübner, 243 †
Piccolo Annuario Geografico e Statistico compilato dal Prof. G. Ricchieri, 243 †
Yellow Fever—
Fièvre jaune et les moustiques, 410 †
Yellowstone, Touring Alaska and the, by C. M. Taylor, 108 †
Yen-ching, China, 262
Yermak, Experimental Trip of the, in 1899, by I. Islyamoff, 779 †
Yew—
Eiben des Ringgaues und des Eichsfeldes, von Luise Gerbing, 522 †
Yezd, Persia, 160
Yo-chau, Hu-nan province, 721
York, Leeds, and Bradford District, Cyclists' Road Map of the, by Rev. J. Bartholomew, 785 †
Yorkshire—
Bradford, Glacial Geology of, by J. Monckman, 105 †
Ingleborough. Part i. Physical Geography, by Prof. T. McK. Hughes, 105 †
Thorough Guide Series, by M. J. B. Baddeley, 104 †
Young, R., African Wastes Reclaimed, 771 †
Younghusband, Major, European Expansion in Asia, 651 †
Yuen Kiang tributary of the Yang-tse, 717
Yukon Territory, Forty-mile in, Mr. Gordon's account of, 640
Yung-peh, 262, 263
Yunnan—
Le Chemin de fer de Lao-Kay à Yun-Nan-Sen, par Commandant L. Schmidt, 396 †
Yunnan—*continued.*
Maps: Yun-Nan, Frontières nord-ouest de l'Indo-Chine (Bureau Top. des Troupes de l'Indo-Chine), 115 †

Z.

Zaborowski, M., Origines des populations anciennes et actuelles de la Russie méridionale et du Caucase, 228 †
Zambezi—
Congo-Zambezi Water-parting, by Captain C. Lemaire, 173 *
Zanzibar, Trade of (Foreign Office Rep.), 108 †
Zarudnoï, N., Voyage en Perse orientale, 752, 769 †
Zeitschrift of the Berlin Geographical Society, 383
Zemmrich, Dr. J., Das deutsche Sprachgebiet in Süd- und Ostböhmen, 391 †
Zemu glacier, Kangchenjunga, 457
Zichy, Grafen Eugen, Dritte Asiatische Forschungsreise des, 652 †
Zietsman, Hon. L., The Native Question in South Africa, 108 †
Zimbabye ruins, 496
Zimmerer, Dr. H., Projektionsbilder als Anschauungsmittel für Schulen, 241 †; Armenien. Eine Kulturhistorische Studie, 768 †
Zimmerman, Dr. A., Trade of the German Protectorates, 656 †
Zimmermann, M., Quelques résultats de l'expedition antarctique belge, 531 †; Le Problème Colonial au début du XX^e^ siècle, 783 †
Zinder, Colonel Péroz's journey to, 218
Zittel, K. A., History of Geology and Palæontology to the end of the Nineteenth Century, 406 †
Zombo Land, Congo, 551; climate of, 553; meteorological observations at, 557
Zoogeography—
Abgrenzung Zoogeographischer Reiche, von Prof. E. v. Martens, 781 †
Distribution géographique . . . aux eaux douces de quelques formes marines, par M. M. Vaney et Conte, 781 †
Zuallardo's Travels, by Colonel C. R. Conder, 654 †; note on, 753
Zuidersee, Reclamation of the, 83
Zulu of Nyasaland, by Rev. D. Fraser, 526 †
Zumbo and Kafue Districts, Journey to the, by P. H. Selby, 605 *
Zwemer, Rev. S. M., Three Journeys in Northern Oman, 54 *; The Wahabis: their Origin, etc., 651 †

INDEX TO MAPS.

EUROPE.

Balkan Peninsula, Central and Western, Map showing Tectonic Structure of the, 737

ASIA.

Aral Sea, Hydrographical data from surveys by Berg and Molchanoff, 504
China, Western: Traverse across the Ya Lung, Yangtse, Mekong, and Salwen rivers to the Irawadi, by R. Logan Jack, 416
Hankau to Canton, Map of a Survey from, 788
India, Central, Sketch-map of supposed underground source of attraction in, 618
Kerman, Plan of, 137
Maldive and Laccadive islands, 279, 283; North Mahlos Madulu atoll in the Maldives, 288
Oman, Northern, Sketch-map of, illustrating Rev. S. M. Zwemer's journey, 61
Persia, Afghanistan, and Baluchistán, illustrating journeys of Major P. M. Sykes, 248
Persia: Helmand river and the Hámun, Sketch-maps 1–4..144, 145; Sistán, Sketch-map of, 141
Tibet, Eastern, showing routes of Captain Kozloff's expedition, 578

AFRICA.

Ashanti, Lake Busumchwi, Mr. Fergusson's survey, 371
Congo-Zambezi Water-parting, illustrating Captain Lemaire's journey, 248
East-Central Africa, Trade routes in, 600
Farafra to Siwa, Route-map, by W. Jennings-Bramly, 120
Kavungu to the Kasai river, Sketch-map of Mr. Schindler's journey, 506
Morocco: Mogador to Marrakesh and thence to Mazaghan, Captain Fawcett's route, 248
Nasser to the Uganda Railway at Lake Nakuro, Map of a Land Journey from, 788
Ndanga District of Mashonaland, Sketch-map by S. P. Hyatt, 636
Rhodesia, North-Eastern, Mr. Selby's routes in, 668
Uganda Protectorate, illustrating Sir Harry Johnston's paper, 120
Zombo Land, illustrating Rev. T. Lewis' journeys, 668

AMERICA.

Alto Paraguay river and part of Eastern Bolivia, Sketch-map of, 69

AUSTRALIA.

Queensland, Sketch-map illustrating the Artesian Water-supply, by W. G. Cox, 668

GENERAL.

Pacific Ocean, Map of the, 788
World: Track of the s.s. *Discovery* from Cowes to Port Lyttelton, 1901..433
World: To illustrate "Interoceanic Communication on the Western Continent, 316

ILLUSTRATIONS AND DIAGRAMS.

EUROPE.

Severn Bore, Plate (Figs. 1–4), to face p. 53

ASIA.

Kangchenjunga—
Kanbachen in Nepal, to face p. 468
Kangchen glacier in Nepal, to face p. 472
Khunza in Nepal, looking north, to face p. 458
Rhododendrons of the Zemu valley, to face p. 454
Maldives—
Lagoon beach of an island, with a fallen coconut, 295
Lagoon beach, showing washing away of the land in fallen coconuts and other timber, 287
Lagoon shoal with sand island, 281
Male island, East point of, 291
Minikoi atoll, Section of the seaward reef of, 288
Raised coral-limestone mass, showing underminiug and erosion, 286
Raised rocks, Line of, with a few trees growing on them to the south of Mudduwari, 293
Rocky outer beach and reef-flat of one of the east islands of North Mahlos, 282
Sections of atolls in the Maldives, 285
Oman, Northern—
Abu Thabi, The castle at, 57
Oman children in feast-day dress, 59
Under a village mango tree in Oman, 55
Persia—
Bandar Abbás, to face p. 168
Bronze axe-head from Khinamán, to face p. 167
Clay formation, Makrán, to face p. 125
Daliki, to face p. 133
Kuh-i-Khoja, Sistán, to face p. 143
Kuh-i-Taftan, Sarhad, to face p. 139
Lut, The, to face p. 155
Persia—*continued.*
Makran scenery, to face p. 131
Pillar of Nádir in the Lut, to face p. 159
Yezd, to face p. 160
Shanghai to Bhamo—
Brine well in dry bed of Yangtse at Kwei-fu, 253
Cast-iron urn in Tsing Yang Kung temple, Chengtu, 255
Ch'a-Erh-Ngai, a typical flat-roofed Mantzu village, 265
Fu river, Gorge on, with covered bridge, 259
Geological party's houseboat in the Middle rapid, Chin-Tan, 251
Peak north of Li-Kiang-Fu, 267
Wai-Yuan mountaineering at Tung-Ling-tse, 263
Women of Li-Kiang Fu, 271
Tibet—
Beggars in Kam, 590
Kozloff making astronomical observations while wintering in Kam, 584
Kuan-Go-Chen, in the Kan-Su province, 594
Mekong, Upper, One of the gorges of the, 596
Mongol of Tsaidam, 588
Yangtse Kiang to the China Sea—
Che-Ling pass towards China sea. Descent from, 713
Fei Kiang, 719
Lei Ho, near Lei-Yang, 717
Parsons pass, Divide between Yang-Tze valley and China sea, 727
Parsons pass, Range at north end of, 729
Sandstone formation overlying Shing-Ning coal-measures, 723
Shing-Ning coal district, 725
Wu Shui gorge above Lo-Chang, 731

AFRICA.

Congo-Zambezi Water-parting—
Dilolo, Lake, Camp on, 186
Ji-Wundu, Limestone plain of, 183; In the limestone valley of the, 185
Congo-Zambezi Water-parting—*contd.*
Ka-Kola stream, on the Congo-Zambezi water-parting, 179
Kassai, Upper, Rapids on the, 175

AFRICA.

Congo-Zambezi Water-parting—*contd.*
Lualaba-Congo, Camp at the sources of the, 187
Lukuleshi, Near the sources of the, 177
Pempere lakelet, 181
Kongo, Ancient kingdom of—
Convent wall, San Salvador, Last piece of the, 545
"Ivory" rocks near San Salvador, 547
Lusengele stream, Kibokolo, 549
Native smithy, Congo, 553
Ruins of ancient church, San Salvador, 543
Manika, The Umvumvumba river in, 373
Uganda Protectorate—
Duwoni, Mount, Ruwenzori. Snows and glaciers on south slopes of, 33
Uganda Protectorate—*continued.*
Elgon, Crater rim of, from the west, 7
Lobelias growing at 11,500 feet (Ruwenzori), 32
Mubuko glacier. Upper, 35; Ice cavern of the, 37
Mubuko river, Ruwenzori, Vegetation of, 23
Nandi plateau, On the, 3
Papyrus marsh, Uganda, 15
Ruwenzori range, General view of, taken from an imaginary height of 10,000 feet, 19
Senecio (*? Johnstoni*) on Ruwenzori at 12,500 feet, draped with *Usnea* lichen, 25
Thomson falls, Sasuru river, South Elgon, 11

AUSTRALIA.

Artesian water-supply—
Flooded country, from an artesian bore, 563
Irrigation from an artesian well, Tulare in California, 569
Artesian Water-Supply—*continued.*
Maxmilton No. 1 Bore, 567
Town bore at Charleville, 565
"Travelling" sheep to water during a drought, Queensland, 561

GENERAL.

Discovery, Voyage southward of the—
Crow's nest on the *Discovery*, 436
Discovery leaving Madeira, 421
Garstang net, 437
Last view of the *Discovery* from Lyttelton, 445
Loose pack-ice, 439
Mainmast under full sail, 419
Officers and staff of the *Discovery* leaving New Zealand, 444
Penguins on Macquarie island, 443
Rain-gauge, placed on the hydrogen
Discovery, Voyage southward of the—*continued.*
cylinders on the port quarter of the *Discovery*, 418
Trinidad island, 424; Coast of, 427; Headland of friable black rock on, 429; Gannet's nest on, 431
Wake of the *Discovery* through the ice, 441
Eyre, Edward John, Portrait of, 99
Livingstone Gold Medal of the Royal Scottish Geographical Society, 381

END OF VOL. XIX.